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HIGH DEFINITION TELEVISION: THE INTERNATIONAL HDTV STANDARD-SETTING PROCESS AND THE ROLE OF INTERNATIONAL STANDARDS ON U.S. COMPETITIVENESS

HEARING

BEFORE THE

SUBCOMMITTEE ON
INTERNATIONAL SCIENTIFIC COOPERATION

OF THE

COMMITTEE ON
SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

ONE HUNDRED FIRST CONGRESS

FIRST SESSION

MAY 31, 1989

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*Ranking Republican Member.

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HIGH DEFINITION TELEVISION: THE INTERNATIONAL HDTV STANDARD-SETTING PROCESS AND THE ROLE OF INTERNATIONAL STANDARDS ON U.S. COMPETITIVENESS

WEDNESDAY, MAY 31, 1989

House of Representatives,
Committee on Science, Space, and Technology,
Subcommittee on International Scientific Cooperation,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:40 a.m., in Room 2318, Rayburn House Office Building, Hon. Ralph M. Hall [chairman of the subcommittee) presiding.

Mr. Hall. It appears that all of the very important members are present so we'll get under way.

The International Scientific Cooperation Subcommittee will come to order.

And, first, of course, I'd like to welcome all of you to today's hearing.

This hearing has been called to take testimony on two important areas relating to high definition television, particularly with emphasis on the standard-setting process and the role of an international HDTV production standard on the competitiveness of a U.S. HDTV industry.

This subcommittee's jurisdiction includes international technological competitiveness and international information and communications policy, and I believe international standards is going to play an increasing role in the ability of the U.S. to compete in the global marketplace.

Today's hearing on HDTV is one of a series of hearings relating to international standards and their impact on U.S. competitiveness.

There is a growing debate in Congress today on the importance of HDTV and its impact, of course, on the U.S. economy. The choice of a domestic or international production standard for HDTV could certainly shape the development of HDTV in this country.

The standard adopted could strongly influence the nature of international competition between the Japanese, European and American companies which plan on marketing equipment and programming in our country here. In the long term, billions of dollars might ride on which standard is adopted.

Testimony from today's hearing will certainly be used in consideration of legislation now pending in the Science Committee to provide for the Federal research and development in support of HDTV and to identify the need for possible legislation modifying the current HDTV production standard-setting process.

To those very distinguished men at our table today who will give us testimony, let me tell you that the aides for most of the members of this committee and subcommittee are here and it's probably more important for them to hear your testimony than it is for us because like after the President makes a speech, people in the press tell us what he said and that's kind of the way it works here, they will highlight your testimony. And, of course, your testimony will be in the record for everyone to view prior to the time we vote.

So please don't be dismayed by the absence of subcommittee members here in person today because by television, watching the newspapers and listening to the radio, you know that there's an awful lot going on here in Washington, D.C. today and members are in all different directions.

So obviously, this subcommittee's interest today is directed toward issues that involve HDTV production standards. While we recognize that there's a close interrelationship between whatever may be done by the FCC on the establishment of transmission standards for domestic terrestrial broadcasting, our interest here is primarily on international production and standards and the existing standard-setting process. That's what lies ahead of us, regardless of whether it's developed before the FCC acts on a transmission standard or developed afterward. We need your input and guidance on the positions that we should take at that time.

[The prepared opening statement of Mr. Hall follows:]

OPENING STATEMENT
HIGH-DEFINITION TELEVISION
RALPH M. HALL

MAY 31, 1989

The Subcommittee on International Scientific Cooperation will come to order.

I would like to welcome all of you to today's hearing. This hearing has been called to take testimony on two important areas related to High-Definition Television (HDTV): the international HDTV production standard-setting process and the role of an international HDTV production standard on the competitiveness of a U.S. HDTV industry.

The Subcommittee's jurisdiction includes international technological competitiveness and international information and communications policy, and I believe international standards will play an increasing role in the ability of the U.S. to compete in the global marketplace. Todays hearing on HDTV is one of a series of hearings related to international standards and their impact on U.S. competitiveness.

There is a growing debate in Congress today on the importance of High-Definition Television and its impact on the U.S. economy. The choice of a domestic or international production standard for HDTV could shape the development of HDTV in the United States. The standard adopted could strongly influence the nature of international competition between the Japanese, European and American companies which plan on marketing equipment and programming in the United States. In the long term, billions of dollars may ride on which standard is adopted.

Testimony from today's hearing will be used in consideration of legislation now pending in the Science Committee to provide for Federal Research and Development in support of HDTV and to identify the need for possible legislation modifying the current HDTV production standard-setting process.

(Turn to other Members)

We are pleased to have witnesses today which represent a cross- section of industries and associations which are impacted by the HDTV standards debate. The first witness will be Mr. Jim McKinney, President of the Advanced Television Systems Committee. Mr. McKinney will provide an overview of the current HDTV production standard-setting process.

Following Mr. McKinney will be Mr. Dan Lankford of AT&T Microelectronics. Mr. Lankford will review the impact of the standards on competitiveness from the perspective of a manufacturer. Mr. Lankford is also closely involved with the Zenith/AT&T HDTV partnership and we have asked him to comment from the perspective of the partnership.

Our third witness today is Mr. Kenneth Phillips, Chairman of the Committee on Corporate Telecommunication Users. Mr. Phillips will be discussing the impact of HDTV on business communications. This is an area in which HDTV technology may have a major impact, but has received little recognition to date.

Fourth on our panel of witnesses is Mr. Richard Solomon of the Massachusetts Institute of Technology Advanced Television Research Program. Mr. Solomon will be discussing how the

HDTV technology represents the convergence of digitally based computer, telecommunication and broadcasting technologies and how the productions standard will impact the U.S.'s ability to compete.

Our final witness will be Mr. Joel Chaseman of Post/Newsweek Stations. Mr. Chaseman is Chairman of the Association of Maximum Service Telecasters. Mr. Chaseman will be describing the impact of the production standard from the perspective of a broadcaster of HDTV programming.

Mr. HALL. I now would recognize the distinguished Minority Leader of this subcommittee, Congressman Packard, the gentleman from California.

Mr. PACKARD. Thank you, Mr. Chairman, ladies and gentlemen.

High definition television, or HDTV as we now know it, is considered by many to be the last hope for revitalization of the United States consumer electronics industry. American competitiveness in HDTV has critical implications for American economic and military security. Many contend that any nation which dominates the United States market for advanced TVs will strengthen its semiconductor and computer industries at the expense of competitors and competitor nations and preserve or gain thousands of jobs in those industries.

The Department of Defense needs high definition video technology for use in fighter airplane cockpits, command centers, training simulators, and analysis groups.

DARPA announced that it will grant $30 million to HDTV research and development. HDTV is off to a head start in Europe and Japan due to substantial funding by their governments and cooperative ventures linking several electronic companies in HDTV development.

These facts have raised critical questions:

Should Congress help create an HDTV industry ?

Does America's future require an industrial policy?

Will America concede foreign leadership in an area that may affect our defense capabilities?

What is the Federal Government's role in HDTV policy?

The Committee of Science, Space and Technology has held prior hearings to discuss the Federal Government's role in fostering a United States HDTV industry. That hearing was a helpful overview of the issue facing the Congress in this important area.

Today's hearing is an effort to further focus attention a critically important question in HDTV debate. How will the standards-setting process affect the United States competitiveness in this area?

The standards dealing with transmission, dealing with production, are critical to the United States and its interplay with Japan and the European communities.

This is the first chance our committee has had to analyze this aspect in detail and we hope our witnesses will bring greater scope and focus and understanding to this issue.

We're very grateful to have the distinguished witnesses with us today. We look forward to your testimony, recognizing that the early as well as the long-term decisions that are made in this area will have profound effect upon this as a viable industry in the United States.

Thank you, Mr. Chairman, for calling the hearing. I look forward to hearing the witnesses.

[The prepared opening statement of Mr. Packard follows:]

RON PACKARD (R-CA)
OPENING STATEMENT
HIGH-DEFINITION TELEVISION
MAY 31, 1989

HIGH-DEFINITION TELEVISION, OR HDTV, IS CONSIDERED BY MANY TO BE THE LAST HOPE FOR THE REVITALIZATION OF THE UNITED STATES CONSUMER ELECTRONICS INDUSTRY.

AMERICAN COMPETITIVENESS IN HDTV HAS CRITICAL IMPLICATIONS FOR AMERICAN ECONOMIC AND MILITARY SECURITY.

MANY CONTEND THAT ANY NATION WHICH DOMINATES THE UNITED STATES MARKET FOR ADVANCED TVS WILL STRENGTHEN ITS SEMICONDUCTOR AND COMPUTER INDUSTRIES AT THE EXPENSE OF COMPETITOR NATIONS AND PRESERVE OR GAIN THOUSANDS OF JOBS IN THOSE INDUSTRIES.

THE DEPARTMENT OF DEFENSE NEEDS HIGH-DEFINITION VIDEO TECHNOLOGY FOR USE IN FIGHTER AIRPLANE COCKPITS, COMMAND CENTERS, TRAINING SIMULATORS, AND ANALYSIS GROUPS. DARPA ANNOUNCED THAT IT WILL GRANT $30 MILLION TO HDTV RESEARCH AND DEVELOPMENT.

HDTV IS OFF TO A HEAD START IN EUROPE AS WELL AS JAPAN DUE TO SUBSTANTIAL FUNDING BY THEIR GOVERNMENTS AND COOPERATIVE VENTURES LINKING SEVERAL ELECTRONICS COMPANIES IN HDTV DEVELOPMENT.

THESE FACTS HAVE RAISED CRITICAL QUESTIONS.

SHOULD CONGRESS HELP CREATE AN HDTV INDUSTRY?

DOES AMERICA'S FUTURE REQUIRE AN INDUSTRIAL POLICY?

WILL AMERICA CONCEDE FOREIGN LEADERSHIP IN AN AREA THAT MAY AFFECT OUR DEFENSE CAPABILITIES?

WHAT IS THE FEDERAL GOVERNMENT'S ROLE IN HDTV POLICY?

THE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY HAS HELD PRIOR HEARINGS TO DISCUSS THE FEDERAL GOVERNMENT'S ROLE IN FOSTERING A UNITED STATES HDTV INDUSTRY. THAT HEARING WAS A HELPFUL OVERVIEW OF THE ISSUES FACING THE CONGRESS IN THIS IMPORTANT AREA.

TODAY'S HEARING IS AN EFFORT TO FURTHER FOCUS ATTENTION ON A CRITICALLY IMPORTANT QUESTION IN THE HDTV DEBATE. HOW WILL THE STANDARDS-SETTING PROCESS AFFECT UNITED STATES COMPETITIVENESS IN THIS AREA?

Mr. HALL. Thank you, Congressman Packard.

The Chair recognizes Mr. Fawell, the gentleman from Illinois, if he would like to make an opening statement.

Mr. FAWELL. I have no prepared statement, Mr. Chairman. I'd just congratulate you on holding this hearing and I look forward to the testimony of the witnesses.

Mr. HALL. Thank you.

We are, of course, pleased today to have witnesses which represent a cross-section of industries and associations that are impacted by the HDTV standards debate.

The first witness will be Mr. Jim McKinney, President of the Advanced Television Systems Committee. Mr. McKinney will provide an overview of the current HDTV production standard-setting process.

Following Mr. McKinney will be Mr. Dan Lankford of AT&T Microelectronics. Mr. Lankford will review the impact of the standards on competitiveness from the perspective of a manufacturer.

Mr. Lankford is also closely associated with the Zenith/AT&T HDTV partnership and we've asked him to comment from the perspective of the partnership if he will.

Our third witness today is Mr. Kenneth Phillips, Chairman of the Committee on Corporate Telecommunications Users. Mr. Phillips will be discussing the impact of HDTV on business communications. This is an area in which HDTV technology may have a major impact, but has received very little recognition to date.

Fourth on our panel of witnesses is Mr. Richard Solomon of the Massachusetts Institute of Technology Advanced Television Research Program. Mr. Solomon will be discussing how the HDTV technology represents the convergence of digitally based computer, telecommunication and broadcasting technologies and how the productions standard will impact the U.S.'s ability to compete, which is very important to us.

Our final witness will be Mr. Joel Chaseman of Post/Newsweek Stations. Mr. Chaseman is Chairman of the Association of Maximum Service Telecasters. Mr. Chaseman will be describing the impact of the production standard from the perspective of a broadcaster of HDTV programming.

So you see we've pretty well covered the waterfront with the standard-setting process, the manufacturer, the effect on business communications, telecommunications, and broadcasting technologies, and how these standards will affect our ability to compete, and then from the perspective of a broadcaster. So we are really looking forward to hearing your testimony.

You certainly can feel at ease to either give us briefly your opening statement or briefly your testimony, or to follow your prepared testimony.

And I want to congratulate this group, each one of you have submitted to us a written statement of your testimony, which is unusual to have it from all five on a committee, but we have that. It will go directly into the record and you feel free to summarize or to present your testimony as you please.

At this time we recognize Mr. McKinney.

STATEMENTS OF JAMES C. McKINNEY, CHAIRMAN, UNITED STATES ADVANCED TELEVISION SYSTEMS COMMITTEE, WASHINGTON, D.C.; DANIEL S. LANKFORD, MARKET DEVELOPMENT VICE PRESIDENT, AT&T MICROELECTRONICS, BERKELEY HEIGHTS, NEW JERSEY; KENNETH L. PHILLIPS, CHAIRMAN, LEGISLATIVE AFFAIRS, COMMITTEE OF CORPORATE TELECOMMUNICATIONS USERS, NEW YORK, NEW YORK; RICHARD JAY SOLOMON, RESEARCH ASSOCIATE, PROGRAM ON COMMUNICATIONS POLICY AND THE MEDIA LABORATORY, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MASSACHUSETTS, AND JOEL CHASEMAN, CHAIRMAN, POST/NEWSWEEK STATIONS, ASSOCIATION OF MAXIMUM SERVICE TELECASTERS, WASHINGTON, D.C.

Mr. McKinney. Thank you, Mr. Chairman. As suggested, I will summarize my statement and ask that the full statement be included in the record at the appropriate place.

I've been Chairman of the United States Advanced Television Systems Committee—ATSC—for only the last two months. However, the ATSC has been active in the standards-setting process for the last six years. The ATSC membership is extremely broad, it represents all aspects of the television industry. And among our 50 or so member corporations and associations are the TV networks, broadcasting associations, the cable television industry, the motion picture industry, and professional and consumer electronics manufacturers —which are both foreign-owned and domestic—along with telephone companies, satellite firms, educational institutions, and standard-setting associations.

My full statement gives some background on HDTV standards work in the United States, and it reports on the international HDTV standards meeting which was held in Geneva just a couple of weeks ago.

The statement also addresses questions which the staff has put to me and to others, and those can be addressed at the appropriate time.

In late 1982, the ATSC was formed by a group which included the Electronics Industry Association, the Institute of Electrical and Electronic Engineers, the National Association of Broadcasters, the National Cable Television Association, and the Society of Motion Picture and Television Engineers.

The ATSC is charged with making recommendations for presentations to the United States Department of State for its use in developing the United States' position on various standards issues that are considered from time to time by the International Radio Consultative Committee—CCIR—and other international organizations.

But besides advising the Department of State during the development of United States positions, the ATSC Charter specifies several other areas of responsibility, including:

the development of the HDTV standards;

the coordination of those standards with other organizations;

the encouragement of the private sector to participate with the U.S. Government agencies in the work ATSC; and a technical review of proposed voluntary standards, and recommendations of standards to appropriate agencies or organizations.

Much of the early work of ATSC in the United States focused on the issue of a worldwide HDTV production standards In 1985 and in 1987, the ATSC recommended that the U.S. support 1125/60—that system—as the single standard.

In January 1988, the full membership of ATSC, by written ballot, voted by a two-thirds majority—that is the majority required by our Charter—to actually adopt 1125/60 as an ATSC standard.

It should be noted that if you eliminate the votes of all ATSC members which are foreign-owned you don't change the outcome, it's still a 2 to 1 vote back last January.

However, much has happened, both domestically and overseas in the past year, to raise serious doubts as to whether the United States should continue to push for early adoption of 1125/60 as the single worldwide HDTV production standard.

Specifically, the European Community—the EC—has indicated that it will not support any system other than one based on 50 Hertz. The EC is also pushing its own system, which is based on 1250 lines and 50 Hertz.

Here at home, congressional and Executive Branch interest in HDTV has certainly peaked during the past year. And the private sector has focused heavily on domestic distribution issues here in the United States. So all of these recent developments caused the ATSC to review its position on 1125/60.

And on April the 14th, 1989, our Executive Committee forwarded its new recommendations to the Secretary of State for his consideration in the development of a U.S. position going in to the CCIR Extraordinary Meeting on HDTV, which was held in Geneva earlier this month.

The Department of State, acting on the advice of, among others, the Federal Communications Commission and the Department of Commerce, adopted the ATSC suggestions for the negotiating position for the CCIR Extraordinary Meeting, which was held May 10 through 16.

The United States position prevailed in all respects at the meeting. I was asked by the Department of State to serve as the primary U.S. spokesman on the standards issues. And in its essentials, the outcome of the CCIR meeting resulted in the following:

There was no selection of any single worldwide HDTV production standard made at the meeting.

There was also no selection of regional standards, that is, perhaps 1250/50 for Europe, 1125/60 for Japan. Those were not approved on a regional basis.

We did approve 18 of 34 basic video parameters, which will be helpful as we pursue future high definition television production standards.

And we established a study program for the concept of Common Image Format and Common Data Rate as a means of transferring programs in the event, which I think is more likely than not, that more than one high definition television production standard is eventually going to be approved for the world.

We also documented both the 1250/50 European system and the 1125/60 system as candidates for a future single worldwide HDTV production standard but we did not select either system.

It seems to me, therefore, that the United States is now perfectly positioned on the issue of the selection of a worldwide standard. We have an opportunity now to complete our technical review of the various systems which are in research and development, both here and abroad, and we also have an opportunity to review innovative approaches to high definition television which have recently been tabled here and elsewhere.

Those who believe that we should establish a unique United States high definition television system now have some time to put some technical meat on the skeleton of that idea.

The United States represents the major—the single major market for consumer electronics products. Proponents of the various systems, both here at home and abroad, know that they must satisfy the needs and the desires of the United States consumer in order to dominate in the world marketplace for high definition television. We have, in effect, become the battleground for those outside the United States with systems proposed.

With regard to our continuing work on the international HDTV production standard, the ATSC is focusing immediately on the issue of Common Image Format. That is the concept whereby all the nations will attempt to agree on virtually all video parameters except for picture repetition rate in order to ease the problem of international exchange among countries using different rates.

One of our technical groups has already begun meeting on this topic and it's our hope that productive work can be completed before the next CCIR meeting, which is in October of this year.

In this connection, by the way, both Australia and Canada have offered technical cooperation on the issue of Common Image Format.

Domestically, the ATSC has been asked by the National Association of Broadcasters just last week to review the new "ghost cancelling" technology on an expedited basis. This task relates to early, low cost, improvements in our current television system but also has implications for future developments in the HDTV environment, and I plan to present that issue to our Executive Committee next month. And, of course, we will continue our work with the Advisory Committee at the FCC—that Advisory Committee dealing with the subject of domestic transmission and distribution systems.

Finally, I'd like to turn briefly to a topic which I believe has very dangerous implications for the United States. Some on Capitol Hill and elsewhere have suggested that the United States withdraw from the international community involved in establishing standards for television in order to promote an all-American system.

The logic behind that position seems to be based on one or more of the following:

That an all-American high definition television standard will encourage the rebirth of our lost consumer electronics industry;

that a separate standard will somehow discourage the importation of foreign-built equipment;

that a domestic high definition television standard will encourage the growth of the United States semiconductor industry; and that all of the above will dramatically improve the United States balance of trade.

History would dictate against proceeding in this direction. I recall very similar arguments being made in the 1970s when the citizen band boom was on. And at a time when virtually every adult in America, including First Lady Betty Ford, was buying a CB set for her car or their homes, the foreign producers of that equipment were in fact flooding the United States market with low-cost equipment.

Early citizen band manufacturers in the U.S., like Motorola and E.F. Johnson, found that they were being priced out of the market while U.S. consumers were finding better bargains but more sophisticated equipment from abroad.

At the insistence of the U.S. manufacturers, the FCC was asked to change the technical specifications for citizens band—I was there at the time—and to change from double sideband to single sideband and to increase the number of channels from 23 to 40.

The argument was made that these changes would have the added benefit of giving a leg up to the United States manufacturers who were ready and willing to provide new equipment at competitive prices.

FCC made those changes—and citizen band died. Foreign manufacturers had their products ready before the U.S. companies got tooled up; prices went up because of the added sophistication that was mandated by the FCC; and people simply quit buying citizen band sets.

In the television field, Brazil offers another historical perspective. In order to promote a domestic television receiver industry in Brazil, they adopted a color television standard known as PAL-M, which is unique to that country. For various reasons the effort was unsuccessful. As a result of adopting the unique standard, however, Brazilian citizens have paid a premium for their television equipment, virtually and all of which is still produced offshore.

France also adopted a unique color television standard known as SECAM, to promote a domestic television manufacturing industry. And Rhonda Crane—whom I met in this room earlier today—used this example for a case study of the use of technical standards as a non-tariff device.

Crane's study makes it clear that the French Government exercised total management control—including a very active promotion, manufacturing and marketing campaign—and served a continuous nurturing role over a long period of time at a great cost to the French taxpayer. The French Government, in an effort to support the SECAM standard, performed many of the tasks fulfilled here in the United States by private companies.

In communications, where radio signals know no borders, international cooperation has repeatedly been shown to be more advantageous than isolation. I am extremely concerned regarding suggestions that technical standards for high definition television should be used to establish trade barriers.

In conclusion, the United States television industry understands the desires of the buying public. It is sensitive to the consumer's cost of improved technology. Some of the suggestions that we've heard for futuristic whiz-bang digital technologies could be extremely expensive if they are, in fact, realistic at all. We could find ourselves building products according to ill-defined maximum standards which few Americans can afford and for which there is little, if any, consumer demand.

If the real problem is one related to unfair trade practices by our trading partners, we have to face that issue head on, much as we did last week with the Super 301 activity.

If we fear for the future of the semiconductor industry in the United States, then national priorities and legislation should address chip manufacturers directly.

If there is concern that too much of our manufacturing base has been sold off to foreign owners, then attention to that matter is certainly called for when foreign entities seek approval of those purchases of our domestic industry.

The television set consumer should not be asked to fund the future competitiveness of the United States semiconductor and computer firms through increased costs of high definition television receivers; and the television industry in the United States cannot and should not be saddled with correcting all of the high-tech trade issues of this country.

Thank you very much, Mr. Chairman. I look forward to the questions at the appropriate time.

[The prepared statement of Mr. McKinney follows:]

STATEMENT OF
JAMES C. MCKINNEY, CHAIRMAN
UNITED STATES ADVANCED TELEVISION SYSTEMS COMMITTEE
TO THE U.S. HOUSE OF REPRESENTATIVES
SUBCOMMITTEE ON INTERNATIONAL SCIENTIFIC COOPERATION

May 31, 1989

I have been Chairman of the United States Advanced Television Systems Committee (ATSC) for only the last two months. However, the ATSC has been active in the business of High Definition Television (HDTV) for six years. The ATSC membership is extremely broad, representing all aspects of our television industry. Among our fifty or so members are the TV networks and broadcasting associations, the cable television industry, the motion picture industry, and professional and consumer electronics manufacturers (both foreign owned and domestic) along with telephone companies, satellite firms, educational institutions, and standards-setting associations involved in our domestic television business. A complete membership list for ATSC is attached as part of Annex A.

My statement gives some background on HDTV standards work in the United States, reports on the international HDTV standards meeting held in Geneva earlier this month, and describes on-going work in support of both domestic and international standards. My statement also addresses questions raised by the Subcommittee and gives views on how the government and the private sector can work to develop technical standards in the best interests of the United States. (A complete set of answers to the Subcommittee's questions is attached as Annex B.)

Background of the ATSC

In late 1982, the Joint Committee on Inter-Society Coordination (JCIC) established the ATSC to coordinate and develop voluntary national technical standards for advanced television systems. The JCIC members -- the Electronic Industries Association (EIA), the Institute of Electrical and Electronics Engineers (IEEE), the National Association of Broadcasters (NAB), the National Cable Television Association (NCTA), and the Society of Motion Picture and Television Engineers (SMPTE) -- are Charter Members of the ATSC.

The ATSC is also charged with making recommendations for presentation to the United States Department of State for its use in developing the United States' positions on various standards issues that are considered from time to time by the International Radio Consultative Committee (CCIR) and other international organizations.

Besides advising the Department of State during the development of United States positions, the ATSC Charter specifies several other areas of responsibility:

- development of HDTV standards,
- coordination of HDTV standards with other organizations,
- encouragement of private sector participation by U.S. government agencies in the work of the ATSC,

-- technical review of proposed voluntary standards, and
-- recommendations of standards to appropriate agencies or organizations.

ATSC Position on the 1125 Line 60 Hertz Production Standard

Much of the early work of ATSC focused on the United States position related to a single worldwide HDTV production standard. In 1985 and in 1987 the ATSC recommended that the U.S. support the 1125/60 system as the single standard. In January 1988 the full membership of ATSC approved the 1125/60 system as an ATSC standard. The vote, collected on a written ballot of the Committee's membership, exceeded the two-thirds majority required by the ATSC Charter for adoption of a standard. (It should be noted that eliminating the votes of ATSC members which are foreign-owned does not change the outcome of the vote.)

However, much has happened, both domestically and overseas, in the past year to raise doubts as to whether the United States should continue to push for early adoption of 1125/60 as the single worldwide HDTV production standard. Specifically, the European Community (EC) has indicated that it will not support any system other than one based on a 50 Hertz picture repetition rate -- the EC is pushing its own 1250 line 50 Hertz system for worldwide acceptance. Here at home, congressional and executive branch interest in HDTV has certainly peaked in the past year. The private sector focus on domestic distribution issues has also intensified. All of these recent developments caused the ATSC to review its position on 1125/60. On April 14, 1989 our Executive Committee forwarded its new recommendations to the Secretary of State for his consideration in the development of a U.S. position "going in" to the CCIR Extraordinary Meeting on HDTV in Geneva earlier this month. A copy of that letter is attached as Annex A.

The CCIR Extraordinary Meeting on HDTV

The CCIR is a permanent organ of the International Telecommunications Union (ITU), the specialized agency of the United Nations for the planning, coordination, regulation and standardization of telecommunications worldwide. The CCIR is based in Geneva and is celebrating its 40th anniversary of television activities.

The Department of State, acting on the advice of, among others, the Federal Communications Commission (FCC) and the Department of Commerce adopted the ATSC suggestions on a negotiating position for the CCIR Extraordinary Meeting (May 10-16, 1989). The United States position prevailed in all respects at the meeting. I was asked by the Department of State to serve as the primary U.S. spokesman on the standards issues. In its essentials, the outcome of the CCIR meeting resulted in:

-- no selection of any single worldwide HDTV production standard at this time,
-- no selection of regional standards (e.g., 1250/50 in Europe, 1125/60 in Japan),
-- approval of 18 of 34 basic video parameters for the future HDTV production standard,

- -- establishment of a study program for the concept of "Common Image Format" and "Common Data Rate" as a means of transferring programs in the event that more than one HDTV production standard is eventually approved, and
- -- technical documentation of both 1250/50 and 1125/60 as "candidates" for a future single worldwide HDTV production standard without adoption of a recommendation for either system.

It seems to me that the United States is now perfectly positioned on the issue of the selection of a worldwide standard. We have an opportunity to complete our technical review of various systems which are now in the research and development stage and to review innovative approaches to HDTV which have recently been tabled. Those who believe we should establish a unique U.S. HDTV system have some time to put technical meat on the skeleton of their suggestion.

The U.S. represents the major market for consumer electronics products. Proponents of various systems, both at home and abroad, know they must satisfy the needs and desires of the U.S. consumer base in order to predominate in the world marketplace.

Future Work of the ATSC

With regard to our continuing work on an international HDTV production standard, the ATSC is focusing immediately on the issue of Common Image Format. This is a concept whereby all nations attempt to agree on virtually all video parameters except picture repetition rate to ease the problem of international exchange among countries using different rates. One of our technical groups has already begun meeting on this topic and it is our hope that productive work can be completed prior to the CCIR meeting this fall. In this connection, both Australia and Canada have offered technical cooperation on Common Image Format.

Domestically, the ATSC has been asked by the National Association of Broadcasters to review the new "ghost cancelling" technology on an expedited basis. This task relates to early, low cost, improvements in our current television system with implications for future developments in the HDTV environment. I plan to present this issue to our Executive Committee next month. Of course, ATSC plans to continue close liaison with the FCC through its Advisory Committee on Advanced Television Service on the topic of domestic transmission and distribution standards.

Use of Technical Standards as Trade Barriers

Finally, I would like to turn briefly to a topic which I believe has very dangerous implications for the United States. Some on Capitol Hill and elsewhere are suggesting that the United States withdraw from the international community involved in establishing standards for television in order to promote a separate "All American" system. The logic behind that position seems to be based on one or more of the following:

- An "All American" HDTV standard will encourage the re-birth of our lost consumer electronics industry.
- A separate standard will (somehow) discourage importation of foreign-built products.
- A domestic HDTV standard will encourage the growth of the United States semiconductor industry.
- All of the above will dramatically improve the United States balance of trade.

History would dictate against proceeding in this direction. I recall similar arguments being made in the mid-1970s during the "citizens band boom." At a time when virtually all adults in the United States (including First Lady Betty Ford) were shopping for citizens band radios for their cars and homes, foreign producers were flooding the U.S. marketplace with low cost equipment. Early U.S. citizen band manufacturers like Motorola and E.F. Johnson found they were being priced out of the market while U.S. consumers were finding better bargains and more sophisticated equipment from abroad.

At the insistence of U.S. manufacturers, the FCC was asked to change the technical specifications for CB -- to change from double sideband to single sideband and to increase from 23 to 40 channels. The argument was made that these changes would have the added benefit of giving a "leg up" to U.S. manufacturers who were ready and willing to provide the new equipment at competitive prices.

FCC made those changes -- and CB died. Foreign manufacturers had products ready before U.S. companies got tooled up; prices went up because of the added sophistication of the equipment; and people simply quit buying citizens band radios.

In the television field, Brazil offers another historical perspective. In order to promote a domestic television receiver industry, Brazil adopted a color television standard, known as PAL-M, which is unique to that country. For various reasons this effort was unsuccessful. As a result of adopting a unique standard, Brazilian citizens have paid a premium for their television equipment, virtually all of which is still supplied by foreign companies.

France also adopted a unique color television standard, known as SECAM, to promote a domestic television manufacturing industry.[1] Rhonda Crane used this example for a case study of the use of technical standards as a nontariff device.[2] Crane's study makes clear that the French government exercised total management control -- including a very active promotion, manufacturing and marketing campaign -- and served a continuous nurturing role over a long period of time at a great cost to the taxpayer. The French government, in an effort to support the SECAM standard, performed many of the tasks fulfilled by private companies in nations such as ours.[3]

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[1] It is worthwhile noting that neither the standards adopted in France nor the standards adopted in the rest of Europe will be used for satellite broadcasting services. Decisions made in 1983, less than twenty years after European color television standards were adopted, call for new standards for satellite broadcasting. The major reason for this decision was to have a common satellite broadcasting standard throughout western Europe.

[2] Rhonda J. Crane, The Politics of International Standards: France and the color TV war, Ablex Publishing Corporation, 1979.

In communications, where radio signals know no borders, international cooperation has repeatedly been shown to be more advantageous than isolation. I am extremely concerned regarding suggestions that technical standards for HDTV should be used to establish trade barriers.

Conclusion

The United States television industry understands the desires of the buying public. It is sensitive to the consumer's cost of improved technology. Some of the suggestions we have heard for futuristic "whiz-bang" digital technologies could be extremely expensive if they are, in fact, realistic at all. We could find ourselves building products according to ill-defined maximum standards which few Americans can afford and for which there is little consumer demand.

If the real problem is one related to unfair trade practices by our trading partners, government should address itself to that issue directly.

If we fear for the future of our semiconductor industry, then national priorities and legislation should address chip manufacturing head on.

If there is concern that too much of our manufacturing base has been sold off to foreign owners, attention to that matter is called for when foreign entities seek approval of their purchases.

The TV-set consumer should not be asked to fund the future competitiveness of U.S. semiconductor and computer firms through increased costs of HDTV receivers; and the television industry in the United States cannot and should not be saddled with correcting all the high-tech trade issues of the United States.

Thank you for asking me to provide this perspective. I will be happy to answer any questions you may have.

James C. McKinney

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[3] Crane, pp. 37-87.

ANNEX A

ATSC

ADVANCED TELEVISION SYSTEMS COMMITTEE
1771 N Street, N.W. • Washington, D.C. 20036-2898 • 202-429-5345

April 14, 1989

The Honorable James A. Baker III
Secretary
Department of State
Washington, D. C. 20520

Dear Mr. Secretary,

As the new Chairman of the Advanced Television Systems Committee (ATSC) I called my first meeting with our Executive Committee on April 14, 1989 for the primary purpose of addressing the topic of the upcoming Extraordinary Meeting of the CCIR. This meeting will consider the subject of an International Studio Standard for High Definition Television (HDTV).

As you will recall, ATSC is composed of a wide range of United States private sector organizations including all the major television networks and broadcasters, the cable television industry, equipment manufacturers, associations, and scientific and professional organizations, all directly interested in HDTV. A membership list is enclosed.

At our meeting I was authorized to inform the Department of State as to the present position of the ATSC related to the CCIR meeting for which the Department is now developing the United States negotiation posture. The recommendations I am outlining here enjoy unanimous support of our Executive Committee.

A SINGLE WORLD PRODUCTION STANDARD FOR HDTV

The ATSC continues to believe that a single world production standard for HDTV would enure to the benefit of producers and consumers of audio-visual programming if such a standard were acceptable to the United States -- clearly the world's leading provider of programming. Additionally, we believe such a single standard could benefit our electronics industry by permitting the manufacture of equipment at lower costs for larger markets.

Toward this end, the ATSC has approved the submission of a standard based on 1125 lines/60 fields to the CCIR. As recently as one year ago, the full membership of ATSC adopted the 1125/60 standard (known specifically as "SMPTE 240M") as an ATSC standard by a margin of more than 2 to 1.

Recently, however, certain developments at home and abroad have raised serious doubts that international agreement on a single world standard can be achieved during the current study period of the CCIR. Specifically:

--The European Community now insists that any system based on a 60 Hertz standard is unacceptable to them. Conversely, the United States clearly cannot accept any standard based on a field rate of less than 59.94 Hertz.

--There is now observed considerable new research and development activity, both in the United States and abroad, concerning transmission standards and *modified or alternative production standards.*

--Some in our private sector believe that attention should be focused first in the area of transmission standards and that a direct linkage exists between production and transmission standards.

--Additional time is required to explore alternative proposals, promising technologies and innovative ideas concerning a possible single world production standard for HDTV.

Therefore, the ATSC recommends that the Department of State establish a negotiating posture which would delay to the next CCIR study period the issue of adoption of a single world production standard for HDTV. In the meantime we would suggest a number of other positions which should be actively explored to the benefit of the United States and all other nations.

COMMON IMAGE FORMAT

The ATSC wishes to express strong support for early exploration of the concept of Common Image Format -- a procedure which may facilitate program exchange without final approval of a single value for picture repetition rate (fields and frames). In this connection, the Executive Committee has directed its Technology Group to turn immediately to a review of this topic with the goal that progress can be made within the present study period of the CCIR. While we realize this will be a difficult task, we would note some earlier interest in this topic by other nations (notably Canada and Australia) and we believe it is an area that may enjoy support within the broader CCIR community.

Future work on Common Image Format can be assisted by our efforts in the CCIR to reach agreements on certain remaining video parameters which will be discussed at the Extraordinary Meeting. Specifically, we suggest the delegation prepare carefully with a view toward promoting world-wide agreement in the following areas:

--Assumed Chromaticity Coordinates for Primary Colors
--Opto-Electronic Transfer Characteristic
--Electro-Optical Transfer Characteristic Before Non-linear Precorrection
--Conceptual Non-linear Precorrection of Primary Signals
--Derivation of Luminance
--Derivation of Color-Difference Signals
--Nominal Level of Component Signals
--Nominal Level of Color-Difference Signals

FURTHER GUIDANCE

The ATSC respectfully recommends that the Department of State also work to achieve these additional goals at the CCIR Extraordinary Meeting:

--Block adoption of any proposal for a single world standard based on the specific field repetition rate of 50 Hertz, or any rate of less than 59.94 Hertz. Also, oppose adoption of video parameters which are dependent upon field repetition rate.

--Oppose CCIR adoption of regional production standards during this study period. Such regional standards would be undesirable in the absence of an ability to exchange programs by some means not now defined. However, if this study period of the CCIR does result in an agreement on Common Image Format, encourage its use in the short term. This should not preclude development of a future unique world production standard.

Finally, the ATSC wishes to take this opportunity to express its appreciation to the Department of State for its past attention to the needs and desires of the United States industries directly involved in the development of HDTV. We are confident that your Department's long-standing interest in the work of the private sector in developing international strategies concerning this issue will continue to benefit the United States. ATSC stands ready to respond on short notice to any unexpected developments at the Extraordinary Meeting which require our input.

Sincerely Yours,

/s/ James C. McKinney

James C. McKinney
Chairman

U. S. Advanced Television Systems Committee
Members and Observers

Members * - Executive Committee Member

* American Television and Communications Corporation
* Ampex Corporation - Audio-Video Systems Division
* Association of Maximum Service Telecasters
AT&T Bell Laboratories - Television Transmission Department
Baylor University - Telecommunications Division
Bell Communications Research, Inc. - Applied Research Division
Cable Television Laboratories, Inc.
* Capital Cities/ABC, Inc.
* CBS Broadcast Group
* Comsat Video Enterprises
David Sarnoff Research Center
Dolby Laboratories, Inc.
Eastman Kodak Company
* Electronic Industries Association
Faroudja Laboratories
General Instrument Corporation - Jerrold Division
Hitachi Denshi America, Ltd.
Hi-Vision America, Inc.
* Home Box Office, Incorporated
Ikegami Electronics (USA), Inc.
* Institute of Electrical and Electronics Engineers
Jansky/Barmat Telecommunications, Inc.
Massachusetts Institute of Technology - Media Laboratory
Mitsubishi Electric Sales America, Inc.
Motion Picture Association of America, Incorporated
* National Association of Broadcasters
* National Broadcasting Company, Incorporated
* National Cable Television Association
New York Institute of Technology
* North American Philips Corporation
Northern Telecom - BNR
Panasonic Broadcast Systems Company
Panasonic Technologies, Inc.
Panavision Electronics
Public Broadcasting Service
Koichi Sadashige & Associates
Sanyo Manufacturing Corporation
Scientific Atlanta
Sharp Electronics Corporation
* Society of Motion Picture and Television Engineers
* Sony Communications Products Company
Sony Corporation of America
* Thomson Consumer Electronics, Inc.
Toko America, Inc.

Toshiba America, Inc.
Tribune Broadcasting Company
Visnews International (USA) Ltd.
* Westinghouse Broadcasting Company, Inc.
* Zenith Electronics Corporation

Observers

Argonne National Laboratory
Asia-Pacific Broadcasting Union (A.B.U.)
2D Navigation Radar Division - Naval Sea Systems Command - Dept of the Navy
European Broadcasting Union (E.B.U.)
Federal Communications Commission
GTE Service Corporation/Telephone Operations
INTELSAT
Malarkey-Taylor Associates
National Aeronautics and Space Administration - Television Development Division
North American National Broadcasters Association (N.A.N.B.A.)
Tektronix, Incorporated
U.S. Army Center for Night Vision and Electro-Optics
Weston E. Vivian

ANNEX B

ANSWERS TO THE QUESTIONS POSED BY THE SUBCOMMITTEE ON INTERNATIONAL SCIENTIFIC COOPERATION

1. Explain the international HDTV production standard setting process: the current status, who is involved and the U.S. government role.

The international organization involved in establishing standards for HDTV production is the International Radio Consultative Committee (CCIR). The CCIR is a permanent organ of the International Telecommunications Union (ITU), and the ITU is the United Nations' specialized agency on telecommunications. The United States has participated in the work of the ITU and CCIR since they were created. The United States has worked actively in international radio matters since the sinking of the Titanic -- and even back to 1865 in matters related to international telegraph issues.

In the United States, issues related to CCIR work are controlled by the Department of State, the Federal Communications Commission and the Department of Commerce. The technical work is performed largely by the private sector but must be approved by these departments and agencies before submission to the ITU in Geneva. This ensures consensus positions taken by the private sector are in compliance with domestic policy considerations before they are presented as United States' positions in the international forums.

In the specific area of HDTV, private sector participation in the CCIR process is extremely broad. The television networks, broadcasters, cable interests, motion picture industry, educational institutions, satellite and telephone companies, and many others have contributed expertise and resources to the effort. The most recent U.S. delegation on HDTV numbered almost 30 persons. The outcome of that meeting is fully discussed in the main body of this testimony.

2. What are the benefits of an international production standard and what is the probability of such a standard being adopted?

Establishment of standards always has positive and negative implications. If they are adopted too early and without great care, standards can freeze technology at an undesirably low level, making it difficult to add innovations as they become available. On the other hand, standards can provide:

- Assurance to equipment manufacturers that they are building to the right level and that a market for equipment will exist.
- In the case of HDTV, ease of transfer of programming material across international borders.
- Increased competitiveness among manufacturers all of whom are building equipment to the same basic level.
- Greater selection of products for the consumer at lower prices.

In the case of HDTV production standards, given the current stalemate between 50 Hertz countries and 60 Hertz countries, the likelihood of a single worldwide standard is not great in the short term. That is why the United States, Australia, Canada, and others are interested in pursuing the concept of Common Image Format (discussed under "Future Work of the ATSC" in the main body of this testimony).

3. What is the appropriate timeframe and process for setting an international HDTV production standard?

Until the recent CCIR Extraordinary Meeting, the decision was to be made in May 1990. With the success of the United States' position in that meeting, we now have up to five years (until 1994) to make that decision. In the interim, the United States will continue to make progress in the concept of Common Image Format which we hope will ease the problem of international exchange of programming in the event that final agreement on a single world standard cannot be reached.

4. What is the relationship between the production and transmission standards and how is this issue addressed in the current standard-setting process?

There is a loose relationship between the two standards. Clearly, the production standard must be better than the transmission standard. You cannot improve on quality at the time of transmission. "Head room" is needed during production to allow for losses during editing, distribution, and transmission. For distribution by terrestrial broadcasting stations where available spectrum is dramatically limited, there is great freedom in selecting a transmission standard at a level that is within the parameters of all suggested international production standards -- providing that a picture repetition rate of not less than 59.94 fields per second is used in the studio. There is no reason to assume that selection of a production standard will drive the choice of a transmission standard.

From a trade balance standpoint, and addressing only the equipment market, the emphasis must focus on the selection of the transmission standard. By far, the largest revenue will accrue to those who sell HDTV receivers to the 90 million United States television households. There is significantly less revenue involved in the marketing of production equipment to studios in New York, Hollywood, or even to our 1400 television stations which may wish to produce programming for HDTV.

That is not to say, however, that the selection of a production standard is unimportant. The United States operates under a very favorable trade balance of cinematic software -- both motion pictures and television programs. There is a 7.2 billion dollar revenue stream involved in United States production and that amount is split about 60% domestic and 40% foreign. Clearly, the United States has a keen interest in protecting its foreign sales of video programming and our interest in a friendly exchange format is very important, even if it is not directly related to the sales of television sets and other video display terminals.

The ATSC and its members are carefully monitoring both the production and transmission standard-setting process to ensure that the American consumer is not disadvantaged by decisions in either area.

5. How will the merging of digitally-based computer, telecommunications, and broadcasting technologies impact the HDTV production standard?

This is an extremely difficult question. With the exception of the merging of display technologies as distinguished from TV sets and computer terminals, it is not at all clear that such a merging will, or should, occur. Ten years ago many scientists predicted that videotext would result in most Americans reading their newspapers on their television sets. Cable television promised interactive services for shopping, banking, and other high-tech, home-based functions. While these technologies are now fully developed, the consumer has not embraced them. And, the early availability of an unlimited pipeline into the home through optical fiber is certainly questionable.

It is simply too early to predict a merging of all digital based technologies in the American home. However, one fact is inescapable. If such a merging is forced, the cost to the consumer will surely increase. The price of a television receiver which also computes, receives the mail, and displays the newspaper may well rise to a level at which only the most elite can afford to buy. Market research should be undertaken by those who suggest the United States should move toward a virtual computer/telecommunications/television terminal before decisions are made to expend federal tax dollars for research, development, and manufacturing.

6. Does the international HDTV production standard-setting process need to change as a result of the merging of computer and HDTV technologies?

No. The process is sufficiently flexible to accommodate whatever future directions we may choose to take. Within the ITU there is not only the CCIR (which has been fully discussed in this testimony) but also the International Telegraph and Telephone Consultative Committee (CCITT) which concerns itself with the international transfer of data streams and other complex digital formats. There is a close coordination between the CCIR and the CCITT and the United States is fully involved in both "CCIs."

Here at home, we believe we are now set on a flexible course that will continue to enjoy virtually unanimous support by all of the private sector elements interested in HDTV.

7. What is the appropriate federal role in the HDTV standard-setting process?

The private sector must be fully involved in the HDTV standard-setting process given the United States' reliance on its private sector for research, development, and manufacture of HDTV equipment. While we must have private sector work first, there must also continue to be a close working relationship between the private sector and the government -- both the Congress and the Executive Branch. The final voice on the issue of HDTV standards will, of course, be from the federal government in order to ensure that the private sector is not moving in a direction that our elected and appointed public policy officials believe is wrong. The ATSC and its members certainly commit to a continuing close cooperation with the government on the issue.

Mr. **Hall**. Thank you, Mr. McKinney.

I think—we are pleased the committee has with us today a very valued observer and a member of the Committee on Science, Space and Technology—not a member of this subcommittee, but certainly one we look to for advice, Congressman Ritter of Pennsylvania is by formal training a scientist—one of the few here—and he sits in with us every now and then. We would recognize Congressman Ritter at this time if you have any statement to make.

Mr. **Ritter**. Mr. Chairman, I just appreciate your allowing me to sit in with the subcommittee, and I would ask unanimous consent that a statement that I have prepared as an opening statement be allowed to be included in the record at this time.

Mr. **Hall**. Without objection, it will be.

Mr. **Ritter**. Thank you, Mr. Chairman.

[The prepared statement of Mr. Ritter follows:]

OPENING STATEMENT OF THE HONORABLE DON RITTER
SUBCOMMITTEE ON INTERNATIONAL SCIENTIFIC COOPERATION
IMPACT OF INTERNATIONAL HDTV PRODUCTION STANDARD ON UNITED STATES COMPETITIVENESS
MAY 31, 1989

THANK YOU, MR. CHAIRMAN.

MR. CHAIRMAN, HIGH DEFINITION TELEVISION AND COMPETITIVENESS ARE TWO ISSUES IN WHICH I HAVE LONG BEEN ACTIVE. WHILE I AM NOT A MEMBER OF THIS SUBCOMMITTEE, I APPRECIATE THE OPPORTUNITY TO PARTICIPATE IN TODAY'S HEARING.

THE UNITED STATES HAS ALWAYS BEEN A MAJOR EXPORTER OF TELEVISION PROGRAMS. THE ACCEPTANCE OF 24 FRAMES PER SECOND 35 MILLIMETER FILM AS A UNIVERSAL PRODUCTION STANDARD HAS MADE IT EASY

FOR OUR TELEVISION AND MOVIE PRODUCERS TO SELL THEIR PRODUCTS IN OVERSEAS MARKETS. AS A RESULT, U.S. TV SHOWS AND MOVIES ENJOY WORLD-WIDE POPULARITY. IF WE DON'T HAVE A UNIVERSAL PRODUCTION STANDARD FOR HDTV, OR IF THERE ARE DIFFERENT PRODUCTION STANDARDS FOR THE U.S. AND EUROPE, FOREIGN BUYERS WILL HAVE TO PAY TO CONVERT AMERICAN PROGRAMS TO EUROPEAN STANDARDS. THIS CONVERSION MIGHT ALSO BE ACCOMPANIED BY A LOSS OF VIDEO QUALITY. ON THE OTHER HAND, OUR CHOICE OF A PRODUCTION STANDARD MAY UNAVOIDABLY LIMIT OUR OPTIONS FOR A TRANSMISSION STANDARD. AND THE CHOICE OF A TRANSMISSION STANDARD WILL STRONGLY INFLUENCE THE ABILITY OF U.S. COMPANIES TO COMPETE IN THE COMING HDTV MARKET, WHICH HAS BEEN ESTIMATED AT $150 BILLION, WORLDWIDE. IT COULD BE DETRIMENTAL TO OUR INTERESTS TO ADOPT A PRODUCTION STANDARD OR A TRANSMISSION STANDARD THAT USED

PROPRIETARY EUROPEAN OR JAPANESE TECHNOLOGY.

U.S. COMPETITIVENESS IS LINKED IN SEVERAL WAYS TO THE HDTV PRODUCTION STANDARD. I HOPE THAT OUR DISTINGUISHED WITNESSES WILL BE ABLE TO ENLIGHTEN US ON HOW WE MAY INFLUENCE THIS LINKAGE TO IMPROVE AMERICA'S POSITION IN THE CONSUMER ELECTRONICS INDUSTRY. ALL TOO FREQUENTLY, RULES, REGULATIONS, AND STANDARDS ARE ADOPTED BEFORE THEIR EFFECT ON OUR COMPETITIVENESS IS UNDERSTOOD. I AM GLAD THAT IN THIS CASE WE ARE LOOKING AT COMPETITIVENESS BEFORE THE STANDARD IS SET. THE STANDARDS THAT WE ADOPT WILL BE CRUCIAL TO AMERICA'S ROLE IN HDTV AND TO OUR COMPETITIVENESS IN THE KEY ELECTRONICS INDUSTRIES OF THE TWENTY-FIRST CENTURY.

THANK YOU, MR. CHAIRMAN.

Mr. **Hall**. All right, at this time, Mr. Lankford, we recognize you.

Mr. **Lankford**. Thank you, Mr. Chairman, and a copy of the statement has already been provided.

I'm Dan Lankford, a Vice President of AT&T Microelectronics, which is the Semiconductor Division of AT&T and also the division which has the joint project with Zenith in the HDTV area.

With me and sitting right behind me is Roy Weber, the Director of the Systems Architecture Center at AT&T Bell Laboratories, and the individual who has primary responsibility for our standards activities within AT&T, and we'll both be available to answer questions once the statement is complete.

As a representative of AT&T and the information movement and management industry, I want to thank you for this opportunity to discuss the critical issue of international HDTV standards and their impact on an important segment of the U.S. economy.

Development of an indigenous high definition television industry is not just a matter of entering the competitive new marketplace, or even of reentering the consumer electronics business, which we've all but abandoned in the United States.

It is a matter of investing in the future well-being of three of our most promising industries: computers, telecommunications and semiconductors.

Just two months ago, one of my AT&T colleagues—Sol Buchsbaum of AT&T Bell Laboratories, told the Committee on Science, Space and Technology that, and I quote, "Unless U.S. industry can get a lion's share of the domestic HDTV market, we will miss not only the coming HDTV wave, but even risk losing our present share of the highly prized telecommunications and computer markets."

There could be a serious impact on the semiconductor industry as well. A small market share for our equipment manufacturers would result in a limited share for our semiconductor manufacturers. The semiconductor companies would then not achieve the volume and technology advantage generated by HDTV, and this in turn would reduce their ability to compete in other market segments where the U.S. companies remain strong, notably telecommunications and computers.

In order to avoid these dangers to a critical sector of our economy, U.S.-owned companies must achieve a major share of our own domestic HDTV market and become key players in the worldwide marketplace. Our foreign competitors have already moved aggressively in this developing market. The question now is whether we will take the actions necessary to catch up and seize a leadership role.

Unfortunately, the risks associated with entering an already established HDTV competition in any significant way are too great for any one company to sustain.

Therefore, government and business must work together to reduce the risks and stimulate creation of an open, competitive HDTV market where U.S.-owned companies are encouraged to make the investments necessary to achieve a significant share.

AT&T, as a leader in the information movement and management industry, believes that HDTV will have far-reaching implications. Not only is it the key to a whole new range of telecommunications services, but it will also be the source of new technologies that will impact fields as diverse as medical technology, computers, and defense electronics.

In recognition of this, our semiconductor unit—AT&T Microelectronics—sought a partnership with Zenith to begin to develop the technologies and chips for HDTV. Our original goal in this project was to have a small R&D effort that would follow the development of the market.

Because government R&D funding lowers the risk of our investment, the prospect of funding by DARPA has emboldened us to accelerate and enlarge our program, and to consider a separate, new program in HDTV display technology. Further, the leadership exercised by DARPA sends a clear signal that HDTV is a strategic technology.

Dr. Craig Fields is to be congratulated for seizing this leadership role. Unfortunately, DARPA's $30 million is inadequate compared to what may be needed. As many of you know, the historical and planned expenditures in Japan and Europe are in the many hundreds of millions of dollars in this technology.

But all the money in the Treasury won't put the U.S. into the HDTV picture unless we have a comprehensive U.S. standards policy that will help promote the interests of both U.S. consumers and U.S. industry, and we believe this is an appropriate role for government leadership.

Standards are rules-of-the-road for the producers of HDTV programs, for the companies that carry HDTV signals, for their customers, and for the manufacturers of HDTV television sets and equipment.

Early on, as you know, there were arguments for a single worldwide set of standards for HDTV. Today that issue is moot. Japan has already established a standard, and the proposed European format is quite different.

The standards process will have a significant impact on the development of our domestic HDTV market and industry. Standards should be set in the best long-term interest of the U.S. market, and our primary concern should ultimately be the U.S. consumer.

Standards are key in at least two areas—program production and transmission. When selecting standards, we need to take an end-to-end systems approach that will consider all transmission media, including terrestrial broadcast, satellite, optical fiber, cable, and stored media.

It is technically possible to fully separate program production and transmission standards, with digitization and processing, but this becomes a cost and quality issue. We believe a systems approach to planning the transmission and program production standards is necessary to simplify the coding and conversion process.

We believe that the Federal Government, and specifically the Commerce Department, should take a leadership role to ensure that a compatible family of HDTV standards is adopted in a timely manner. Clearly, the FCC has, and should continue to have, the authority to set standards for over-the-air transmission.

The Commerce Department should provide the leadership to ensure that these standards, and other transmission, program production and HDTV-set standards, interface smoothly and best meet the needs of the American market.

In considering HDTV standards, critical factors are the ease of transition from our current television system, and the cost of the total HDTV system, including the receiver. These factors will in large measure determine the pace of HDTV market development.

Another concern is the ability of the selected standards to accommodate new services and technology advances, including optical fiber to the home.

Promising concepts that should be explored include a friendly family of standards to deal with different transmission media, and a common image format to make conversions between the different European, Japanese and U.S. standards cost-effective.

One aspect of HDTV not often discussed is its potential for merging telecommunications with entertainment video. The future will hold tremendous increases in image-related services such as teleconferencing, as well as medical imaging, and services such as computer-aided design.

Also, the reuse of image software among a variety of media will become increasingly important. We need to foster this merger by choosing standards that simplify the transfer and interaction between entertainment and computer imaging.

Standards cannot provide a competitive long-term advantage, because global manufacturers will quickly modify their equipment to meet U.S. standards. But standards can help level the playing field initially. And for this reason, the strategic and economic impact of the standards established must also be carefully considered.

Clearly, the HDTV standards-setting process is an extremely complex one that involves many considerations. It is also a process which will have a profound impact on our society well into the next century.

HDTV developments, including many promising new ideas such as Zenith's Spectrum Compatible HDTV proposal, are now nearing the stage that requires structured experimental evaluation.

We propose that these evaluations, along with other considerations previously mentioned, become inputs to a carefully coordinated standards process led by the Commerce Department. The goal should be to establish a family of HDTV standards in a timely manner consistent with the state of the art and the development of the U.S. HDTV industry.

Under any circumstances, we should not hasten to establish a standard for just one aspect of HDTV, such as program production, in isolation from the other elements of the system. Such a move could result in a technically inferior system and could have a negative impact on the development of our domestic HDTV market and industry.

The U.S. has the know-how needed to develop a viable HDTV industry. And U.S. industry is willing to make the required investments. What we need now is government leadership and action to reduce the risk of market entry for U.S. companies.

We believe that a key element in this process is the appointment of an HDTV executive within the Commerce Department. This individual would lead and coordinate the complex process of implementing a U.S. HDTV industry, with the support of the electronics industry and key government agencies such as DARPA and the FCC.

Government financial support is also critical to help "jump-start" the industry. In this area, we generally support many of the concepts recently proposed by the American Electronics Association.

Another aspect of the AEA proposal that has particular merit is that government institute a policy of encouraging market-driven fiber-optic access to the home. Such a policy would not only aid the growth of HDTV, but would also stimulate a whole new range of information services.

The emerging HDTV industry represents both an enormous risk and an opportunity for the United States. We are at a crossroads, and we do not have the option of standing still. If we do nothing, we risk serious damage to a strategic industry that is the largest single employer in the country.

If industry and government can forge a partnership and act in a coordinated manner in the best long-term interests of the country, then we have an opportunity to significantly strengthen our country economically, technologically, and socially.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Lankford follows:]

STATEMENT OF

DANIEL S. LANKFORD

MARKET DEVELOPMENT VICE PRESIDENT

AT&T MICROELECTRONICS

BEFORE THE

U.S. HOUSE OF REPRESENTATIVES

SUBCOMMITTEE

ON INTERNATIONAL SCIENTIFIC COOPERATION

COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

MAY 31, 1989

As a representative of AT&T and the information movement and management industry, I want to thank you for this opportunity to discuss the critical issue of international HDTV standards and their impact on an important segment of the U.S. economy.

Development of an indigenous high-definition television industry is not just a matter of entering a competitive new marketplace, or even of re-entering the consumer electronics business that we have all but abandoned.

It is a matter of investing in the future well-being of three of our most promising industries: computers, telecommunications and semiconductors.

Just two months ago one of my AT&T colleagues -- Sol Buchsbaum of Bell Labs -- told the Committee on Science, Space and Technology that, and I quote, "Unless U.S. industry can get a lion's share of the domestic HDTV market, we will miss not only the coming HDTV wave, but even risk losing our present share of the highly prized telecommunications and computer markets."

There could be a serious impact on the semiconductor industry as well. A small market share for our equipment manufacturers would result in a limited share for our semiconductor manufacturers. The semiconductor companies would then not achieve the volume and technology advantage generated by HDTV, and this in turn would reduce their ability to compete in other market segments where U.S. companies remain strong, notably telecommunications and computers.

In order to avoid these dangers to a critical sector of our economy, U.S.-owned companies must achieve a major share of our own domestic HDTV market, and become key players in the worldwide marketplace. Our foreign competitors have already moved aggressively in this developing market. The question now is whether we will take the actions necessary to catch up and seize a leadership role.

Unfortunately, the risks associated with entering an already established HDTV competition in any significant way are too great for any one company to endure.

Therefore, government and business must work together to reduce the risks and stimulate creation of an open, competitive HDTV market where U.S.-owned companies are encouraged to make the investments necessary to achieve a significant share.

AT&T, as a leader in the information movement and management industry, believes that HDTV will have far-reaching implications. Not only is it the key to a whole new range of telecommunications services, but it will also be the source of new technologies that will impact fields as diverse as computers, medical technology, and defense electronics.

In recognition of this, our semiconductor unit -- AT&T Microelectronics -- sought a partnership with Zenith to begin to develop the technologies and chips for HDTV. Our original goal was to have a small R&D effort that would follow the development of the market.

Because government R&D funding lowers the risk of our investment, the prospect of funding by DARPA has emboldened us to accelerate and enlarge our program, and to consider a separate, new program in HDTV display technology. Further, the leadership exercised by DARPA sends a clear signal that HDTV is a strategic technology.

Dr. Craig Fields is to be congratulated for seizing this leadership role. Unfortunately, DARPA's $30 million is inadequate compared to what may be needed. Historical and planned expenditures in Japan and Europe are in the many hundreds of millions.

But all the money in the treasury won't put the U.S. into the HDTV picture unless we have a comprehensive U.S. standards policy that will help promote the interests of both the U.S. consumer and U.S. industry, and this is an appropriate role for government leadership.

Standards are rules-of-the-road for the producers of HDTV programs, for the companies that will carry HDTV signals to their customers, and for the manufacturers of HDTV sets.

Early on there were arguments for a single worldwide set of standards for HDTV. Today that issue is moot. Japan has already established a standard, and the proposed European format is quite different.

The standards process will have a significant impact on the development of our domestic HDTV market and industry. Standards should be set in the best long-term interest of the U.S. market, and our primary concern must be the U.S. consumer.

Standards are key in two areas -- program production and transmission. When selecting standards, we need to take an end-to-end systems approach that will consider all transmission media, including terrestrial broadcast, satellite, optical fiber and stored media.

It is technically possible to fully separate program production and transmission standards with digitization and processing, but this becomes a cost and quality issue. We believe a systems approach to planning the transmission and program production standards is necessary to simplify the coding and conversion processes.

We believe that the Federal government, and specifically the Commerce Department, should take a leadership role to ensure that a compatible family of HDTV standards is adopted in a timely manner. Clearly, the FCC has, and should continue to have, the authority to set standards for over-the-air transmission. The Commerce Department should provide the leadership to ensure that these standards, and other transmission and program production and HDTV set standards, interface smoothly and best meet the needs of the American market.

In considering HDTV standards, critical factors are the ease of transition from the current television system, and the cost of the total HDTV system, including the receiver. These factors will in large measure determine the pace of HDTV market development.

Another concern is the ability of the selected standards to accommodate new services and technology advances, including optical fiber to the home.

Promising concepts that should be explored include a friendly family of standards to deal with different transmission media, and a common image format to make conversions between different European, Japanese and U.S. standards cost-effective.

One aspect of HDTV not often discussed is its potential for merging telecommunications with entertainment video. The future will hold tremendous increases in image-related services such as teleconferencing, medical imaging, and CAD.

Also, the re-use of image software among a variety of media will be increasingly important. We need to foster this merger by choosing standards that simplify transfer and interaction between entertainment and computer imaging.

Standards cannot provide a competitive long-term advantage, because global manufacturers will quickly move to modify their equipment to meet U.S. standards. But standards can help level the playing field initially. For this reason, the strategic and economic impact of the standards established must also be carefully considered.

Clearly, the HDTV standards-setting process is an extremely complex one that involves many considerations. It is also a process which will have a profound impact on our society well into the next century.

HDTV developments, including many promising new ideas such as Zenith's Spectrum Compatible HDTV proposal, are now nearing the stage that requires structured experimental evaluation. We propose that these evaluations, along with the other considerations previously mentioned, become inputs to a carefully coordinated standards process led by the Commerce Department. The goal should be to establish a family of HDTV standards in a timely manner consistent with the state of the art and the development of the U.S. HDTV industry.

Under any circumstance, we should not hasten to establish a standard for just one aspect of HDTV, such as program production, in isolation of the other elements of the system. Such a move could result in a technically inferior system, and could have a negative impact on the development of our domestic HDTV market and industry.

The U.S. has the know-how needed to develop a viable HDTV industry. And U.S. industry is willing to make the required investments. What we need now is government leadership and action to reduce the risk of market entry for U.S. companies.

We believe that a key element in this process is the appointment of an "HDTV executive" within the Commerce Department. This individual would lead and coordinate the complex process of implementing a U.S. HDTV industry, with the support of the electronics industry and key government agencies such as DARPA and the FCC.

Government financial support is also critical to help "jump-start" the industry. In this area, we generally support many of the concepts proposed by the American Electronics Association.

Another aspect of the AEA proposal that has particular merit is that government institute a policy of encouraging market-driven fiber-optic access to the home. Such a policy would not only aid the growth of HDTV, but would also stimulate a whole range of new information services.

The emerging HDTV industry represents an enormous risk and opportunity for the United States. We are at a crossroads, and we do not have the option of standing still. If we do nothing, we risk serious damage to a strategic industry which is the largest single employer in the country.

If industry and government can forge a partnership and act in a coordinated manner in the best long-term interests of the country, then we have an opportunity to significantly strengthen our country economically, technologically, and socially.

# # # #

Mr. HALL. Thank you, Mr. Lankford.

Chairman Phillips, we recognize you at this time.

Mr. PHILLIPS. Good morning. Thank you, Mr. Chairman.

My name is Kenneth Phillips, I am Chairman of Legislative Affairs and appearing on behalf of the Committee of Corporate Telecommunications Users, which represents some 30 of the largest telecommunications users in the country before Congress, the FCC, and State Telecommunications Regulatory Commissions.

I am also an adjunct Professor of Telecommunications Policy at New York University, and Vice President for Telecommunications at Citicorp in New York.

Other members of the CCTU span a wide variety of fields and industries, including finance, insurance, credit cards, telemarketing, private universities and even large municipalities such as the City of New York.

We deeply appreciate having the privilege of coming before you today and sharing a few thoughts on the subject of what is generally called "high definition television."

The occasion is particularly noteworthy because we represent not one broadcaster, not one manufacturer of television receives or other broadcast or recording equipment.

Why, you might quite rightly ask, would a group comprised of such a seemingly unaffected constituency wish to present here today?

The answer lays in the fact that history shall reflect that our topic today has about the same relationship to television as the vitality of the rubber industry might have to automobiles. We do not dispute or wish to reduce the perceived importance of this matter to the broadcast industry, nor to any future U.S. consumer electronics manufacturing sector.

We do, however, wish to state without any equivocation that far more is at stake. What has already been lost to competitive disintermediation is sadly gone, and may, or may not be recoverable.

Our country remains the central synapse of world information flows as over 70 percent of the world's most frequently used databases reside here, representing millions of dollars of telecommunications revenues and income to those in the software industry as well.

Just last week I was visiting with senior management of the Telecommunications Administration for our neighbor to the south, Mexico, and learned that 80 percent of all international communications in and out of Mexico is with the United States. This is not an atypical ratio.

All this is happening just at a moment in history when the distribution of wealth around the globe has shifted away from being predominantly manufactured goods, to patterns of bits and bytes, be they representing a funds transfer order of millions of dollars, the latest news story, movie or electronic messages between individuals of distant lands.

Information and the ability to compete and profit from its transport and processing is, however, fundamentally different from manufactured goods in one key respect: it has a very limited shelf life, or what I like to call, borrowing the term from physics, a "half-life." This is simply the amount of time which passes while a piece of information loses one half of its value.

As telecommunications technologies advance, this period of time becomes shorter, now measurable in seconds, or in the financial industry, even fractions of seconds. For this reason, the costs, economies, and efficiencies with which information is transmitted around the globe at the speed of light becomes central to a given competitor's position in world information markets. This, in turn, is going to hinge on issues such as the standards-setting process for high definition television, our topic today.

While most who address you on this subject will no doubt be focusing solely on the so-called "production standard," we offer a loud and clear warning signal: the production standard for HDTV and the transport standard for broadband telecommunications networks and delivery systems are closely related to one another from an economic and efficiency viewpoint as well as the technological viewpoint.

While I suppose it's conceivable that any format or data transmission protocol could be converted into any other format, these are the costs and processing delays of which market share and product position in the ever-increasingly competitive global telecommunications field are made.

Much has been said of the role of off-shore players in this overall debate, particularly the Japanese and their MUSE standard. You have heard from others far more qualified than I to discuss the efficacy of MUSE from a television and display technology viewpoint, but what has become apparent to the large telecommunications users is that if adopted as a worldwide standard, the ability to cotransmit other forms of digital information, including traditional data and voice packets, on an efficient basis over the same fiber optical-based broadband channel could be severely compromised.

This is a matter of so much importance that you should not take it on faith. And, for this reason, I am asking that the record be left open so that we may submit additional technical details amplifying these and other areas of our testimony.

As you know, a number of different standards are on the table from various parts of the world. While considerable energy has been devoted to examining the implications of these for broadcasters, who dominate the FCC's Advanced Television Government Advisory Committee, dangerously little has been done in terms of analyzing the competing standards from a broadband telecommunications or business viewpoint.

Ultimately, these telecommunications implications of HDTV will have a great deal to do with the rate at which the United States makes advanced information services as ubiquitously available in the future, as basic telecommunications services are today.

This statement assumes, however, that information and entertainment resources are going to be delivered somewhat differently in the future than they are today. The 6 and 8 megahertz bandwidth of broadcast television appears to be insufficient for most of the HDTV formats without the use of impressive compression techniques which could have the ultimate effect of increasing receiver prices considerably above today's levels.

On the surface, it would appear that the cable television industry is ideally positioned to be the distribution vehicle for HDTV, however, this would be a vastly suboptimal alternative, in our opinion, since the incremental marginal cost of adding information and even basic voice telephony to broadband HDTV signals is actually staggeringly low. And, unfortunately, only a very small percentage of the cable systems in the United States are able to accommodate a two-way flow of bits, because of their architecture and placement of linear amplifiers.

Digitization of the cable industry could be financially risky as well without the backbone of basic telecommunications services to support the endeavor. This, of course, leaves the telephone industry, which both has the universal access and to the business and residential sector, but which has already embarked upon deployment of narrow band ISDN consisting of two 64 Kilotbit channels, plus a single digital signaling channel. These, of course, are inadequate for carrying full motion imaging, the one service which consumers appear willing to pay for. Nonetheless, the telephone industry has demonstrated an ability to provide high quality on a reliable, if at times costly basis.

In order for the telephone companies and the public to enjoy the full potential of broadband, fiber optic cabling will have to be provided not only between the central offices, as is already happening, but surely to its large data users perhaps first, and at least to remote nodes serving clusters of residential customers, if not directly into their homes.

The telephone industry avers that the cost of this would be staggering and would result in local rate shock of a totally unacceptable order of magnitude. This is true only if one assumes that the implementation of broadband has to take place simultaneously in all revenue sectors.

I recently completed a study for the Columbia University Center for Telecommunications and Information Studies which identifies an approach whereby a portion of the receivables from broadband service revenues provided by the large data users is essentially escrowed for service, or rather, use in capitalizing deployment of fibers to the residential or less densely populated areas where the access costs are significantly higher.

Regulatory and tax policy issues would have to be brought into line with this goal, most notably finally developing a realistic depreciation environment for all telecommunications users and providers.

Information discussions between the CCTU and tax authorities have revealed a general willingness to modify traditional views on depreciation once sufficient explanation of the technologies is made. Such gear as optoelectronics should be replaced, in the interest of tighter efficiencies long before it is so-called "obsolete" in the traditional sense of the word.

Telecommunications providers, regardless of their role in the HDTV drama should be afforded this flexibility as soon as possible and not constrained to the use of aging technology long overshadowed by offshore players, because of the elements of U.S. tax policy written before the invention of the transistor.

On the other hand, allowing telephone companies unfettered entrance into information services provision in such a broadband scenario raises a host of serious policy questions in the areas of cross ownership, privacy, security, transaction services, and intellectual property rights enforcement.

For example, under which circumstances should a telephone company providing entertainment and information services be able to also provide electronic yellow pages?

Does a telecommunications company selling lists of subscribers who call certain numbers associated with expensive resorts, foreign countries, or even organizations having known social or political views, constitute a breach of an implied contract of privacy between the subscriber and the telecommunications provider?

If the telephone company enters the transaction processing field, responding to point of sale terminal transactions, or direct response to media advertising, does today's panoply of terminal devices meet accepted tests in place today in the financial services field for authentication of transactions appearing as debit items on tomorrow's telephone bill?

We think not, but recognize that if digitized movies, home security, energy management, voice facsimile, high resolution music, and personal computer-based communications are all to be provided over one stream of light emanating from a minutely thin fiber of glass entering the home, then the terminal device of the future will in fact bare little resemblance to the telephone set of today.

These policy issues are direct outcomes not of far-fetched experiments leading to future products, but of the merger of technologies, all of which exist in various forms today. These issues should be of as much concern, if not more concern to the Committee than the number of pixels or other purely technical issues within the standard-setting process alone.

This is all the more reason why we must move with caution in setting the standards for HDTV. The production and manufacturing opportunity stemming from the production of integrated, intelligent, multimedia terminal devices of the future is several orders of magnitude greater than that represented by simply a television having higher definition.

We are told that only a few companies, most notably IBM, recognize this and are pursuing the notion of a multimedia work station, or receiver, but again have to note that virtually none of the major components are manufactured in the United States.

The United States should not endorse anyone else's production standard now but strive for excellence in developing an integrated receiver/work station hospitable to all of the major protocols which may evolve. The lack of a common image format could in fact lead to one set of standards for television and another set of standards for digital communications, terminal devices, computers, and the like. This, we feel, would be a great mistake.

We'd like to make the following recommendations in closing:

Firstly, since the standards-setting process as it presently exists does not include a study mechanism examining the relation between production and transmission standards from the telecommunications technology and policy vantage point, before any appropriation or support for a federally-supported HDTV effort is launched, an impartial and temporary institute be formed for this purpose. Such an effort should be jointly managed by government, for example, by NIST, academic research centers having expertise in this area, such as MIT, Carnegie Mellon, and Columbia, and bring together the views of users, information providers, and potential manufactures of hardware, as well as the telecommunications and entertainment industries.

Secondly, so that such an effort does not result in the stagnation and cessation of research, development , and investment in related technologies in which the United States does enjoy a position of significant leadership, (for example, active matrix display technologies and software,) we encourage Congress pressing forward with the efforts to stimulate ongoing work, such as that proposed by DARPA in the high resolution display area, as well as in encouraging joint, cooperative efforts on the private sector side.

While exemptions from antitrust regulation, specialized tax credits, and even possibly low interest matched financing under particular circumstances may be appropriate, we are not in favor of direct subsidies.

Finally, government's role in this critical standards-setting effort is far more easily defined than executed. Part of the price we must pay for having a society which leads the world in technological innovation with such ingenuity and spontaneity is minimizing government regulatory control, thus allowing the competitive marketplace to be the ultimate arbiter. Nonetheless, the multiple agencies having a legitimate role in matters of telecommunications , technology, and foreign relations often have not, usually through no fault of their own, acted in concert, or in the long term best interest of the private sector.

To that end, the establishment of a Science Advisory Board on HDTV and Broadband Telecommunications, comprised of senior representative of the Department of State, Office of National Science Advisor, FCC, NIST, and NTIA on the government side, and each of the major elements of the private sector, including users, that is to say, information providers identified above, should receive serious consideration.

The final positions taken by such a Board would be binding to the extent of formulating presentations in international fora. In addition, it would provide valuable input to administrative and regulatory agencies having jurisdiction over the many areas broadband and HDTV concerns.

If we are to retain the label "HDTV" as what history will surely reflect upon as a misnomer for one of the most critical strategic initiatives we can take at this time, let us at least be clear in knowing that what we are working with is neither simply building televisions to support a service for which there is no appreciable demand at present, nor funding a rescue mission for the consumer electronics industry.

Both concepts are a bit misleading and not likely to succeed if viewed as isolated sets of technology issues. Rather, our focus should be upon providing access to the information technologies of the future with the greatest efficiency and at the lowest possible cost to the consumer. Through this approach we not only minimize the risk of bogging down in micromanaging a complex cobinatorial problem, but reaffirm our faith in a system which has served both our own country and world markets well, most especially in the fields of science and technology.

Thank you.

[The prepared statement of Mr. Phillips follows:]

U.S. HOUSE OF REPRESENTATIVES

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

INTERNATIONAL STANDARDS FOR HIGH DEFINITION TELEVISION

Comments of the

Committee of Corporate Telecommunications Users

Kenneth L. Phillips, Sci. Adv. & Chairman,
Legislative Affairs

May 31, 1989
Washington, D.C.

Good morning. My name is Kenneth Phillips, I am Chairman for Legislative Affairs and appearing on behalf of the Committee of Corporate Telecommunications Users, which represents some thirty of the largest telecommunications users in the country before Congress, the FCC, and State Telecommunications Regulatory Commissions. I am also an adjunct Professor of Telecommunications Policy at New York University, and Vice President of Telecommunications at Citicorp, in New York. Other members of the CCTU span a wide variety of fields and industries, including finance, insurance, credit cards, telemarketing, private universities and even municipalities such as the City of New York.

We deeply appreciate having the privilege of coming before you today and sharing a few thoughts on the subject of what is generally called "High Definition Television." The occasion is particularly noteworthy because we represent not one broadcaster, not one manufacturer of television receivers or other broadcast or recording equipment. Why, you might rightly ask, would a group comprised of such a seemingly uneffected constituency wish to present today?

The answer lay in fact that history shall reflect that our topic today has about the same relationship to television as the vitality of the rubber industry might have to automobiles. We do not dispute or wish to reduce the perceived importance of this matter to the broadcast industry, nor to any future U.S. consumer electronics manufacturing sector. We do however wish to state without any equivocation that far more is at stake. What has already been lost to competitive disintermediation is sadly gone, and may, or may not be recoverable. Our country remains the central synapse of world information flows as over 70% of the world's most frequently used databases reside here, representing millions of dollars of telecommunications revenues and income to those in the software industry. Just last week I was visiting with the senior management of telecommunications for our neighbor to the South, Mexico, and learned that 80% of all international communications in and out of Mexico is with the United States.

All this is happening just at a moment in history when the distribution of wealth around the globe has shifted away from being predominantly manufactured goods, to patterns of bits and bytes, be they representing a funds transfer order of millions of dollars, the latest news story, movie, or electronic message between individuals of distant lands. Information and the ability to compete and profit from its transport and processing is however fundamentally different from manufactured goods in one key respect: it has a very limited shelf life, or what I life to call "half-life." This is simply the amount of time which passes while a piece of information looses one half of its value.

As telecommunications technologies advance, this period of time becomes measurable in seconds, or even fractions of seconds. For this reason, the costs, economies, and efficiencies with which information it transmitted a round the globe at the speed of light becomes central to a given competitor's position in the world information marketplace. This in turn is going to hinge on issues such as the standards-setting process for "High Definition Television."

While most who address you on this subject will not doubt be focusing on the "production standard," we offer a loud and clear warning signal: the production standard for HDTV and the transport standard for broadband telecommunications networks and delivery systems are closely related to one another from an economic and efficiency viewpoint. While I suppose it is conceivable that any format or data transmission protocol could be converted into any other format, these are the costs and processing delays of which marketshare and product position in the ever increasingly competitive telecommunications field are made.

Much has been said of the role of off-shore players in this overall debate, particularly the Japanese and their MUSE standard. You have heard from others far more qualified to discuss the efficacy of MUSE from a television and display technology viewpoint, but what has become apparent to the large telecommunications users is that if adopted as a world-wide standard, the ability to co-transmit other forms of digital information, including traditional data and voice packets, on an efficient basis over the same optical fiber-based broadband channel could be severely compromised. This is a matter of such importance that you should not take it on faith. For this reason I am asking that record be left open so that we may submit additional details amplifying this and other technical areas of our testimony.

As you know, a number of different standards are on the table from various parts of the world. While considerable energy has been devoted to examining the implications of these for the broadcasters, who dominate the FCC's Advanced Television Government Advisory Committee, dangerously little has been done in terms of analyzing the competing standards from a broadband telecommunications viewpoint. Ultimately, these telecommunications implications of HDTV will have a great deal to do with the rate at which the United States makes advanced information services as ubiquitously available if the future, as basic telecommunications services are today.

This statement assumes however that information and entertainment resources are going to be delivered somewhat differently in the future than they are today. The 8 Mhz bandwidth of broadcast television appears to be insufficient for most of the HDTV formats without the use of impressive compression techniques which would have the effect of increasing receiver price considerably above today's levels. On the surface, it would appear that the cable television industry is ideally positioned to be the distribution vehicle for HDTV, however this would be a vastly suboptimal alternative since the incremental marginal cost of adding information and even basic voice telephony to a broadband HDTV signal is staggeringly low. and Unfortunately only a very small percentage of the cable systems in the United States are able to accommodate a two-way flow of bits, because of their architecture and placement of amplifiers.

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[4] Testimony of the Corp. Comm. Telecommunications Users. May 31, 1989.
House Committee on Science, Space, and Technology

This of course leaves the telephone industry which both has the universal access into both the business and residential sector, but which has already embarked upon deployment of narrowband ISDN consisting of two 64Kb/sec. channels, plus a single digital signalling channel. These of course are inadequate for carrying full motion imaging, the one service which consumers appear willing to pay for. Nonetheless, the telephone industry has demonstrated an ability to provide high quality service on a reliable, if at times costly basis.

In order for the telephone companies and the public to enjoy the full potential of broadband, fiber optic cabling will have to be provided not only between central offices as is already happening, but surely to its large data users, and at least to remote nodes serving clusters of residential customers, if not directly into their homes. The telephone industry avers that the cost of this would be staggering and would result in local rate shock of a totally unacceptable order of magnitude. This is true only if one assumes that the implementation of broadband has to take place simultaneously in all revenue sectors. I recently completed a study for the Columbia University Center for Telecommunications and Information Studies which identifies an approach whereby a portion of the receivables from broadband service revenues provided the large data users is essentially escrowed for use in capitalizing deployment of fibers to the residential or less densely populated areas where access costs are higher. Regulatory and tax policy issues would have to be brought into line with this goal, most notably finally developing a realistic depreciation environment for all telecommunications users and providers.

Information discussions between the CCTU and tax authorities have revealed a general willingness to modify traditional views on depreciation once sufficient explanation of the technologies is made. Such gear as optoelectronics should be replaced, in the interest of tighter efficiencies long before it is "obsolete" in the traditional sense of the word. Telecommunications providers, regardless of their role in the HDTV drama should be afforded this flexibility as soon as possible and not constrained to the use of aging technology long overshadowed by offshore players, because of elements of U.S. tax policy writen before the invention of the transistor.

On the other hand, allowing telephone companies unfettered entrance into information services provision in such a broadband scenario raises a host of serious policy questions in the areas of "cross ownership," privacy, security, transaction services, and intellectual property rights enforcement. [For example, under which circumstances should a telephone company providing entertainment and information services be able to also provide "electronic yellow pages?" Does a telecommunications company selling lists of subscribers who call certain numbers associated with expensive resorts, foreign countries, or even organizations having known social or political views, constitute a breach of an implied contract of privacy between a subscriber and the telecommunications provider? If the telephone company enters the transaction processing field, responding to point of sale terminal transactions, or direct response to media advertising, does today's panoply of terminal devices meet accepted tests in place today in the financial services field for authentication of transactions appearing as debit items on tomorrows telephone bill? We think not, but recognize that if digitized movies, home security and energy management, voice, fax, hi resolution music, and personal computer-based communications are all to be provided over one stream of light emanating from a minutely thin fiber of glass entering the home, then the terminal device of the future will in fact bare little resemblance to the telephone set of today.

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This is all the more reason why we must move with caution in setting the standards for HDTV. The production and manufacturing opportunity stemming from the production of integrated, intelligent. multi-media terminal devices of the future is several orders of magnitude greater than that represented by simply a television having higher definition. We are told that only a very few companies, most notably IBM recognize this fact and are persuing the notion of a multimedia workstation/receiver but again have to note that virtually none of the major components are manufactured in the US.

We would like to make the following recommendations:

Firstly, since the standards-setting process as it presently exists does not include a study mechanism examining the relation between production and transmission standards from telecommunications and policy vantage points, before any appropriation or support for a Federally supported HDTV effort is launched, an impartial and temporary institute be formed for this purpose. Such an effort should be jointly managed by government, i.e., NIST, academic research centers having expertise in this area, i.e., MIT, Carnegie Mellon, Columbia, and bring together the views of users, information providers, and potential manufactures of hardware as well as the telecommunications and entertainment industries.

Secondly, so that such an effort does not result in the cessation of research, development, and investment in related technologies in which the United States does enjoy a position of significant leadership, i.e., active matrix display technologies, we encourage Congress pressing forward with efforts to stimulate ongoing work, such as that proposed by DARPA in the high resolution display area, as well as in encouraging joint, cooperative efforts in the private sector. While exemptions from antitrust regulation, specialized tax credits, and even possibly low interest matched financing under particular circumstances may be appropriate, we are not in favor of direct subsidies.

Finally, government's role in this critical standards-setting effort is far more easily defined than executed. Part of the price we must pay for having a society which leads the world in technological innovation with such ingenuity and spontaneity is minimizing governmental regulatory control, thus allowing the competitive marketplace to be the ultimate arbiter. Nonetheless, the multiple agencies having a legitimate role in matters of telecommunications, technology, and foreign relations often have not, usually through no fault of their own, acted in concert, or in the long term best interest of the private sector. To that end, the establishment of a Science Advisory Board on HDTV and Broadband Telecommunications, comprised of senior representatives of the Department of State, Office of National Science Advisor, FCC, NIST, and NTIA on the government side, and each of the major elements of the private sector, including users/information providers in the private sector identified above should receive serious consideration. The final positions taken by such a Board would be binding to the extent of formulating presentations in international fora. In addition, it would provide valuable input to administrative and regulatory agencies having jurisdiction over the many areas broadband and HDTV concerns cover.

If we are to retain the label "HDTV" as what history will surely reflect upon as the misnomer for one of the most critical strategic initiatives we can take at this time, let us at least be clear in knowing that what we are working with is neither simply building televisions to support a service for which there is no demand at present, nor funding a rescue mission for the consumer electronics industry. Both concepts are misleading and not likely to succeed if viewed as isolated sets of technology issues. Rather, our focus should be upon providing access to the information technologies of the future with the greatest efficiency and at the lowest possible cost to the consumer. Through this approach we not only minimize the risk of bogging down in micromanaging a complex combinatorial problem, but reaffirm our faith in a system which has served both our own country and world markets well, most especially in the fields of Science and Technology.

Thank you.

Mr. **Hall**. Thank you, Mr. Phillips, and we will leave the record open—I think we can leave it open for 14 days. And we might also ask you to agree to questions that additional members may want to submit to you to have put in the record.

Mr. **Phillips**. Absolutely, Mr. Chairman, thank you.

Mr. **Hall**. The Chair recognizes Mr. Solomon.

Mr. **Solomon**. Thank you.

My name is Richard Solomon. I'm a Research Associate at The Media Laboratory at the Massachusetts Institute of Technology and the Program on Communications Policy. I always have to give a—

Mr. **Hall**. Mr. Solomon, we can't hear you on the record.

Mr. **Solomon**. Okay.

Mr. **Hall**. Are you okay now?

Mr. **Solomon**. I'll start again.

Mr. **Hall**. All right, thank you, sir.

Mr. **Solomon**. My name is Richard Solomon. I'm a Research Associate at The Media Laboratory at MIT and the Program on Communications Policy at MIT. I always have to give a disclaimer that the opinions in my testimony are not that of MIT or The Media Laboratory. We often have a running joke that they are not the opinions of ourselves either, but we'll leave that.

I am a consultant also to the Organization for Economic Cooperation Development in Paris where I've just completed the preliminary phase of a major study reviewing the standard-making process in communications and computers. Some of the views in this paper are based upon that study for OECD.

In a rational world, the government would keep out of most standards issues, except for those directly affecting the mission of government agencies themselves—military, public safety, and the like.

Standards are very complicated. There are too many economic and non-technical issues involved to trust the government to make the right decisions. Experience has shown the free market tends to do better. Furthermore, in the United States, thanks to to the Constitution, entertainment broadcast television is not a government activity, and neither is movie production.

This is not to say the government has no role at all. I certainly support the initiative of DARPA in research and development, what the Commerce Department may do in that area, and the suggestions of the American Electronic Association for antitrust, tax benefits, and the like. I'm talking only about standards-making.

All things being equal, the State Department should have recognized that in the first place and made it clear to the International Telecommunication Union that the U.S. Government was not going to participate in standards-making for high definition production. Had that position, of course, been rejected by the Europeans and Japanese, and they had gone on their own, we could have actively opposed any effort by other governments to set production standards for our industries. We're the single largest consumer and producer of video and film in the world. We do have clout. We can get such views across. Unfortunately, we did not.

The world is not rational. Things are not always equal, I recognize that. That doesn't mean we should continue doing irrational things, but we now have to include our mistakes in our future strategic planning.

Normally, the U.S. Government does not get involved in establishing entertainment standards. Compact audio disk standards are an example. The U.S., in fact, has not been involved in CD standards at all. They were done by Philips and Sony, which ought to tell us something about what's going on in the world.

The absurdity of the ITU's involvement in HDTV production standards can be illustrated by imagining how we would have reacted if NHK or the European Community set out to establish in an international forum what the spatial or temporal resolution should be of the photochemical process currently used by Hollywood. We call that film. The thought is not that absurd, because the SMPTE—a standards organization for motion pictures and television—has recently opened a discussion to increase the frame rate of theatrical film from 24 frames per second to 30 frames per second—that would made it more compatible with American TV production. The Europeans immediate reaction was that there was a plot to force them to buy new projectors. It is not going anywhere at all right now.

Besides absurdity, there are other things wrong with establishing standards for vision systems in the ITU environment. Not the least is the forum—the CCIR is neither representative of all the primary interests involved in future high resolution systems, nor has any mandate beyond coordinating things that have to do with electromagnetic spectrum, space allocation, and so forth.

The claim that worldwide HDTV production standards have to be decided by the CCIR in order that international broadcasters could interchange HDTV videotapes before standards for HDTV transmission distribution or display have been adopted would be akin to designing the details of a new high-speed railway system by designing the locomotives first before we plan on the detail of track, gauges, profiles, and, of course, traffic.

The analogy, of course, is not to bits and bytes; but the analogy is to displays, transmission technology, and applications for high resolution systems. They come first.

Those are where the bottlenecks will be for distribution—to the end user. Agreement in those areas have to come before production and tape interchange is standardized. Not that production parameters are not related to transmission and display, for if you pick the production standards first—as has been suggested by both the Europeans and the Japanese—you get locked into certain critical technologies for distribution and for TV set design. That's why the Japanese have been so keen to get us to adopt their system, to the point where they have claimed they will give us the licenses to the technology for production free. In the financial field that's called disintermediation.

Had NHK been successful in convincing us to accept their system, we would then be obliged to use their proprietary chips for transmission and display technology. We taught the world had to do business that way—it's called subsidizing the razor to sell razor blades.

Vision systems are more complicated than razors, and so it's not always clear what we're being sold. However, it's not that hard to figure out; because there is one simple, basic fact about high resolution video systems: in their raw form they eat bandwidth. The raw form of the NHK system, for instance, would be 90 megahertz. There's absolutely no way that could be broadcast or even put on tape, so that compression technologies are needed for dealing with high definition TV or even high resolution systems. We need it for storage, for transmission and display.

It's even true for fiber optics. Though the fiber has enormous bandwidth, its nodes, its switches, terminal interfaces, will still work better, and more elegantly if bandwidth is conserved. So the proprietary compression technologies are the equal to razor blades in this instance.

The simple fact that none of this has ever been brought up at the CCIR, in terms of economic facts of razors and razor blades, indicates that something is wrong with the international standards process. It's something that needs correcting.

Of all the economic interests in the future high definition systems—the U.S. computer electronics industry, the motion picture industry, the production houses; broadcasters, large and small; the telephone industry, the cable providers, the various government departments concerned with national security, trade, and even things like air traffic control—had they all sat down together a decade ago when HDTV proposals began to surface from Japan, events may have been different. Unfortunately, it didn't happen.

We failed to grasp the opportunity to steer things our way when the timing was right; now we have to confront a new, very powerful issue. Two economic entities that are our trading partners and trading rivals have developed high definition system that they desperately want us to buy. We are the single largest market, of course, as two of our speakers mentioned before. We don't have to lie down and be sold things. We don't have to buy things we don't want.

The HDTV battle is simply not over. We can make this position clear to the CCIR and to our trading partners. We can tell our trading partners a few things, for example:

1. We can say the "Emperor has no clothes." Both the EC and the NHK HDTV production standards are intended as throwaway systems. Their near-term delivery mechanisms are simply not well thought out. We know that and we talk about it in the halls. We should say it publicly and get it done with.

The difficult problems of how to deliver HDTV has always taken a back seat to flashy production technology. It looks good at trade shows and at congressional hearings. The systems proposed are analog, they are merely extensions of today's television techniques. As such, they are very wasteful of spectrum and bandwidth. They are clever in some respects but they are poorly designed to be compatible with existing television; there's no transition strategy whatsoever; they require complicated converters. Instead, they have been optimized for direct satellite delivery, not over-the-air broadcasting, not cable, not future fiber.

DBS is an iffy proposition. In the United States there are many alternate sources of programming. I'm not denying that DBS should be given a chance to try. I don't think it's going to be successful. There's no reason why we have to back a system that is only good for one terrestrial system and bad for all the others. Even in Europe and Japan, DBS is having some problems today.

A future high definition television system for the U.S. should be designed to be efficient for multiple media, and there are ways of doing that. We should say this at the CCIR. We should say the systems are simply not ready, they're not well developed, and we should understand that when we're negotiating with our trading partners for whatever reasons.

2. We should point out that the systems are not compatible with the future. As analog systems, both proposals add unnecessary problems when interfaced to either computer systems of today or future digital delivery mechanisms. And, of course, digital storage devices, which will come.

There's little disagreement that digital technology is the wave of the future for video electronics. The only disagreement we hear is that it might cost too much now, and we don't know when it's going to come. If we want, we can address that a bit later. I have two papers attached, written by my colleagues, which discuss future television systems. This gets very technical and we can get very distracted thinking about that, so I will skip it for now.

The Europeans and Japanese are not stupid. They know their current analog proposals are throwaway. Why do they bother? Because they know that to get from here to there you have to start moving. They hope to get us to pay them to learn what high resolution systems are all about—what the markets are about, how to handle the compression technologies , the delivery mechanisms, and so on; then they will be ready when the next generation of digital high resolution systems come. It may be us, it may be them; it all depends on who does work on it.

The current discussion of whether we should wait to leapfrog misses the point. You cannot leapfrog unless you work. We have to begin to work on the future right now and we have to work on it in terms of a transition from the existing systems.

3. High resolution systems will, by definition, encompass more than broadcast television. The applications abound, even the Japanese say so in their marketing literature. We should say so at the CCIR as well.

The digital revolution may come earlier than the broadcasters expect for high resolution vision systems. I have a suspicion that you're going to see more high resolution outside the broadcast field in the next five years than within the entertainment industry. We know that because we know computers need it. We need it for displays, in radar and air traffic control. We need it for medical and industrial applications. We need it for computer enhancment, of imaging. Teleconferencing can improve with better displays. There are numerous business and educational area: from interactive automatic point-of-sale terminals to sales aids in showrooms; computer-aided design and manufacturing, of course.

Many of the systems we're working with today have much higher resolution, much better images than anything that has been proposed by the Japanese or the Europeans.

These are valuable niche markets, one that will depend heavily on interfacing with computer and telecommunications standards as well as video—full motion video.

The needs are immediate. The software and image capture systems are already more mature than those for broadcasting. Those are the reasons I think they're going to come first. This could help us leapfrog.

The systems proposed so far by NHK and the EC take little into account other than broadcasting. The NHK system, for example, is interlaced, incorporating all the problems that interlace has on today's TV systems; postproduction is always difficult with interlace. It adds artifacts, degrades the picture. Interlace was a brilliant idea when we introduced it in the U.S. back in the late 1920s, but it is not the future.

The European Eureka system is not interlaced—it's progressive, but it runs at a lower frequency; the same 50 Hertz they use today and it flickers. It is true one can get used to the flicker, but why bother? For the next 50 years do we want to develop systems that flicker, that are difficult to capturing fast motion, that are hard to use for postproduction? We can do much better than that.

4. We should point out that there is no immediate, desperate need for high definition television. We should stop pretending that there's a crisis if we don't adopt a single worldwide standard today; it is not the end of the world.

There are many good reasons to slow the process, not the least is that the TV and motion picture industries in the U.S. are simply not ready to enter the HDTV production business. It is too early. If we don't buy the HDTV product, it is unlikely that anyone else in the world will invest too much in it; our market is too big to ignore, as I said before.

But it begs the question: The reason there is no HDTV product ready to roll is because we're thinking of a lot of myths. We think that we can get 10,000 or 18,000 movies out of the Hollywood libraries and be HDTV-ready tomorrow. We have looked at those films. Hollywood has looked at them, too. They are not at all convinced that they are going to look well on high definition television. Most of them were made many, many years ago.

Some film stock is too old; quality levels are too poor; and besides, the content is what counts. There's only a few hundred of all the films that have ever been made out of the 10 or 18,000, or however you count—that includes, of course, silent films—that are regularly rented at video stores or even shown on the cable channels. We've seen those already. I don't think they are going to have much of a market for high definition.

We need new products. That means we have to ramp up a production industry. We have to learn about the economics of production in HDTV. It is not clear it is cheaper than existing television. Some of the experiences show that it may be at least as expensive as making major motion pictures. That shouldn't be surprising.

The reason a major motion picture is expensive is because quality is one of the details they have to watch—and quality costs. HDTV will demand greater quality.

One of the serious areas that we have to think about in HDTV in terms of the film industry is that if we eliminate the theatrical experience, replacing it with direct home view, there might not be enough reserve to make the movie in the first place; and so we end up with all low-level television quality. For that we don't need high resolution.

A second area which I don't discuss in my paper, but one which we have a lot of concern, is the protection of intellectual property. If HDTV is too good, it means they're giving their masters out to the public to steal. That could be handled if we design a high definition television system from scratch to have copyright protection built in. Again, it can be done. It is very hard to add things like that later. It is not as difficult to add it in the beginning. That's technical and we can get into that another time.

5. HDTV impinges on several different delivery media. We should tell that to the CCIR Study Groups and that there's more than the CCIR Study Groups which are concerned with HDTV: The Telegraph and Telephone Study Group of the ITU, the CCITT; other forums such as the International Standards Organization. And besides, there's quite a few more than that are very much concerned with high definition systems. They have begun study groups that would like to coordinate. There was some effort made at the past CCIR meeting in Geneva that I was at, but we've got to make sure that they take that seriously and it's not just lip service.

I think the telephone industry can help here. They need to get involved in the CCIR committees if they really believe they're going to carry television, and indicate that their technology is just as important as the broadcast technology and to require some coordination about standards. There are a lot of technical details that are very serious, and if they are ignored now we may end up with two disparate systems.

More important is that the broadcast interests of today cannot be abandoned to some indefinite future. There will be a transmission—transition-to better television, HDTV, or whatever we call it. It's going to take a long time. It won't happen quickly if we have a big fight among ourselves between the film, TV, cable, and telco industries. But more important is we've got to have a transition plan as part of any plan toward HDTV. We don't see that in the systems that are proposed to us.

That also means starting a program of research and development now because we're going to have to compete in the international scene one way or another. We can't leapfrog, as I said before, just by ignoring everything.

And, 6, I have a solution. One is that if a production standard is adopted—this might be a little bit sarcastic but I think we can make this serious—if a production standard is adopted that's incompatible with our needs by the CCIR, or if we have two production standards—one for Europe and one for Japan—we can simply tell both of them, that's fine, we'll take all of it, because there are ways of handling multiple production systems simpler on the display end, on the transmission end, than on the production end. After all, we deal with multiple production systems today; film is not perfectly compatible with television, but it works. We accept television programs from Europe, and they work.

We can do better if we design display systems that would be compatible with all of those, plus something even better. This would simply short-circuit the process. It would call the bluff of the Europeans and Japanese. I suspect it would go very little further because they know we would be competing now in real serious fields.

We could also stop discussing pixels per line, number of lines of the screen, shape of the pixel and other nonsense. None of that, by the way, makes any sense.

In the attached paper that I have from Professor Bill Schreiber at MIT, he discusses clearly that the only compatibility standard that is of any concern for future systems is that of frame rate. We can have an agreement on number of pixels on a line and spatial parameters—they are very easy to trans-code. The frame rate is the tough one and that has to be done on the display end.

Thank you.

[The prepared statement of Mr. Solomon follows:]

Testimony of
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Before the
Subcommittee on International Scientific Cooperation,
Committee on Science, Space and Technology
U.S. House of Representatives

Hearings on the Impact of International Standards
on High Definition Television
May 31, 1989

The Role of Government in HDTV Production Standards

In a rational world, the government would keep out of most standards issues, except for those that directly affect the mission of government agencies — the military, public safety, and the like. Standards are complicated, and there are too many economic and non-technical issues involved to trust the government to make the right decisions; the free market tends to do better. Furthermore, thanks to our Constitution, entertainment broadcast television is *not* a government activity in the United States, and neither is movie production.

All things being equal, the State Department should have made that clear to the International Telecommunication Union in the first instance, and stated that the U.S. government would not participate in standards-making for high-definition production, and had that position been rejected, indicate that *we would actively oppose any effort by other governments to set production standards for our industries.* As the single largest consumer and producer of video and

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film, we *do* have the clout to get such views across. We don't have to buy anything from anyone that we don't need or want.

Unfortunately, the world is not that rational, and things are not always equal. However, that does not argue for encouraging irrationality, just for including reality in strategic planning.

Normally, the U.S. government does not get involved in establishing consumer entertainment standards. Compact audio disk standards are an example; in fact the U.S. has not been involved at all in CDs, nor has the ITU. CDs were done by Philips and Sony working outside of their governments, which should tell us something about what is really going on in the world.

The absurdity of the ITU's involvement in HDTV production standards can perhaps be illustrated by imagining how we would have reacted if NHK or the European Community set out to establish in an international forum what the spatial or temporal resolution should be of the photo-chemical process currently used by Hollywood to put images on film? Indeed, the thought is not that absurd, for when the SMPTE opened a discussion to increase the frame rate of theatrical projection from 24 frames per second to 30 fps (to make it more compatible with American TV production), the Europeans immediately saw a plot to force them to buy new projection equipment just to show American films.

Besides absurdity, there are many things wrong with establishing standards for vision systems in the ITU environment. Not the least is that the forum chosen — the Coordinating Committee for International Radio — is neither representative of all the primary interests involved in future high-resolution systems, nor has any mandate beyond coordinating things that have to do with the electromagnetic spectrum. Claiming that worldwide HDTV production standards have to be decided by the CCIR so that international broadcasters could interchange HDTV videotapes before any standards for HDTV transmission or consumer

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distribution have been adopted is akin to designing the details of highspeed locomotives before the new highspeed railroad system is planned; you might start on fundamentals, but the details have to await decisions on gauges, track profiles, and traffic.

The analogy of the railroad for high-resolution systems are the displays, transmission technology, and applications. These are where the bottlenecks will be for distribution to the end user; agreement in those areas must come *before* production and tape interchange are standardized. Not that production parameters are not related to transmission and display, for *if you pick production standards first you may get locked into critical technologies for distribution and for TV sets.* That's why the Japanese have been so keen to get us to adopt their system, to the point where they have claimed they will give us the licenses to the technology for free. In the financial field, the Japanese strategy is called disintermediation. Had NHK been successful in convincing us to accept their system, we may have been obliged to use their proprietary chips for transmission and display technology. We taught the world such business techniques — it's called subsidizing the razor to sell razor blades.

Vision systems are somewhat more complicated than razors, so we have to explore deeper to figure out just what we are being sold. It's not that hard to figure out, because there is one basic fact about high-resolution video systems: they eat bandwidth! This means that all HDTV systems must use some method of compression and decompression for storage, for transmission, and for display. (This is even true for fiber optics which has enormous bandwidth capacity because fiber's nodes, switches, and terminal interfaces will still work better if bandwidth is conserved.) The proprietary compression technologies equal razor blades.

The simple fact that HDTV standards-making has gone so far without the economic facts of razors and razor blades surfacing in the CCIR indicates that something *is* wrong with the international standards process that needs correcting.

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Had all the economic interests in future high-definition systems -- the U.S. computer and electronics industry, motion picture production houses, broadcasters large and small, the telephone industry, cable providers, and various government departments concerned with national security, trade, and even things like air traffic control — sat down a decade ago, when HDTV proposals began to surface from Japan, events may have been different.

We were all asleep at the switch, and now all things are not equal; so like it or not, our government is involved up to its ears. One goal of this committee would be to find ways to extricate the government from HDTV standards making without giving us *de facto* systems supported by other governments. I have such a suggestion at the end of my testimony.

Since we failed to grasp the opportunity to steer things our way when the timing was right several years ago, now we have to confront the issue that two powerful economic entities have developed high-definition systems that they want us to buy. But we do not have to lie down and be sold, for the HDTV battle is not over, and we can make our position clear in the CCIR and other trading fora, to wit, we can tell our trading partners that:

1) The Emperor has no clothes. Both the EC and the NHK HDTV production standards are intended as "throwaway systems" with near-term delivery mechanisms that are not well thought out.

The very difficult problems of how to deliver HDTV has always taken a back seat to flashy production technology which looks good at trade shows and Congressional Hearings. The systems proposed are analog, merely extensions of today's television techniques, and as such are very wasteful of spectrum and bandwidth. Very clever in some respects, they are poorly designed to be compatible with existing TV and require complicated convertors. They are instead optimized for direct satellite delivery, not over-the-air

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broadcasting, nor cable, nor fiber. DBS is an iffy proposition in the U.S. where there are many alternate sources of programming; in Europe and Japan DBS might make sense, but even that is uncertain. A future HDTV system for the U.S. should be designed to be efficient for multiple media.

At the CCIR, we should recognize the Emperor's New Clothes for what it is, say these systems are simply not ready nor well developed, and keep these defects in the back of our mind whenever we negotiate on standards.

2. The systems are not compatible with the future. As analog systems both proposals will add unnecessary problems when interfaced to either today's computer systems or future digital delivery mechanisms and digital storage devices.

There is little disagreement that digital technology is the wave of the future for electronics; the only argument is when it will come.

The Europeans and Japanese are not stupid; they know their current analog proposals are throwaways, so why are they bothering? Because they know that to get from here to there you have to start moving. They hope to get us to pay them to learn what high-resolution systems are all about — the markets, the compression technologies, the delivery mechanisms — so they will be ready with the next generation of digital high-resolution systems when it comes. The current discussion of whether we should wait and leapfrog misses the point that to leapfrog we have to start right now, working with what exists, and improving on that. The transition to the future is as important as the future, otherwise someone else will make that transition for us.

We cannot ignore the HDTV standards debate at the ITU or elsewhere, but there are ways to orient to our needs.

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3. High-resolution systems will, by definition, encompass more than broadcast TV. Applications abound, even the Japanese say so. We should say so at the CCIR as well.

The digital revolution may come earlier than the broadcasters expect for high-resolution vision systems. Computers need them, in fact, many computer displays already are higher quality than that proposed for HDTV. Radar and air traffic control will use high-resolution displays. Medical and industrial applications include computer-enhanced X-rays and other imaging. Tele-conferencing can improve with better displays. There are numerous business and educational arenas, from better displays for interactive automatic point-of-sale terminals to sales aids in showrooms and computer-aided design and manufacturing.

These are valuable niche markets that obviously depend heavily on interfacing with computer and telecommunications standards as well as video. It is likely that these industries will be the first to use high-resolution displays in large quantities, for unlike entertainment, the needs are immediate, and the software and image capture systems are more mature than that for broadcasting. These are some opportunities for the U.S. to leapfrog without waiting.

The systems proposed by NHK and the EC take little into account other than broadcasting, and even that is not done with future applications in mind: The NHK system is interlaced, incorporating all the problems that interlace has on today's TV systems, making postproduction difficult, adding artifacts which degrade the picture. Interlace was a brilliant idea when we invented it in the late 1920's to conserve bandwidth, but it is not the future. The European Eureka system, while not interlaced, runs at the same 50 Hertz frequency as their current systems. Do we really want to establish a high-resolution system for the next fifty years that still flickers, or fails to capture fast motion properly? Surely we can do better than that for posterity.

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The CCIR forum is not where U.S. computer and electronics industries make decisions on standards. While their needs may be greater in complexity than that of the broadcast community, their profitability is not something we want to ignore. They too can benefit from the scale that broadcasting brings to the video display market. Together there is a symbiotic relationship that can accelerate the demand for true high-resolution systems.

4. There is no immediate desperate need for high-definition TV, and we should stop pretending that there is such a crisis at CCIR meetings. If the CCIR does not adopt a single worldwide standard for HDTV now, it is not the end of the world.

Indeed there are good reasons to slow the process, not the least is that the TV and motion-picture industries in the U.S. are simply not ready and can lose their collective shirts by entering HDTV production too early. If we don't not buy HDTV product, it is unlikely that anyone else will invest too much; our market is too big to ignore.

But this begs the question, for,there is no HDTV product ready to roll. The myth that Hollywood has 10,000 to 18,000 movies in their library "HDTV-ready" is one we should convince the Japanese is true, so they may relieve the U.S. film vaults at current high prices before the crash. Most of the movies in the vaults are either too old to have been shot at quality levels that would look good on a high-resolution screen, too out-of-date to be of interest to current and future audiences other than film buffs like me, or they bombed the first time at the box office for reasons other than quality.

Only a few hundred of all the films ever made are regularly rented at video stores or shown on the plethora of cable channels. HDTV is not likely to make these any more attractive, and besides a large audience has already seen them; the next generation may take a few years to mature before they are ready for anything beyond *Snow*

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White and *Bambi* in HDTV. Again, the HDTV proponents have not clearly thought out the delivery mechanism: HDTV is going to require new product, and a lot of new product.

More important will be production costs and returns on investment. It is not clear that electronic film production will be cheaper. HDTV, like high-definition film, may cost more than normal TV because of lighting, sets and details on the screen. (And film is still higher in resolution — and getting better, ask Kodak — than any of the proposed HDTV production standards.) The few HDTV productions made are inconclusive, or to be fair, do not point to lower costs yet. Major Hollywood movies do not cost ten times more than TV programs without a reason, and quality of the image is one of them. So, financing a major HDTV production may be more in the scope of film for the theater than that of today's TV programs. Eliminating the theatrical exposure for direct home view may not be what is needed to get HDTV rolling.

5. HDTV impinges on several different delivery media, and we should tell the CCIR Study Groups that we want to discuss the details with the CCITT (telegraph and telephone), and other in standards fora such as ISO.

Some effort at the past CCIR HDTV meeting was made in this regard, but we need to make sure it is taken seriously. If the telephone companies really believe they are going to carry television, they should get active on the CCIR committees, and see to it that standards are coordinated with the CCITT; it will not happen by magic. Similarly, the cable industry talks about fiber optics too, but they have to understand the intricacies of digital transmission, switching, and computer interfaces.

Most important, the broadcast interests must not be abandoned to some indefinite future. If the transition to HDTV over different media is to take place, it won't happen quickly by positioning four powerful interests against each other — film, TV, cable and the

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telcos. It would be much better to find transition technologies, set sunset time parameters for such things as over-the-air NTSC, PAL and SECAM, and gradually evolve towards better television and superior displays. That means coordination with Broadband ISDN planning on national and international levels. It means starting a program of R&D now to compete on an international scene.

By not settling our internal differences as to the future of video and its relationship to other media and to the electronics industries we are simply handicapping ourselves so someone else can solve our problems for us. This we don't have to announce at CCIR meetings, the other countries already know that when they sit down to negotiate with us.

6. We can announce the good news to the CCIR. There is a solution to the HDTV production standard issue. We don't need one!

This might be blasphemy to some, but the standards group has almost acquiesced to the idea in rudimentary form. There is implicit understanding that there is no way to adopt a single standard, so the broadcasters have compromised on an interim "common image format" research effort. The chances of the CIF becoming a permanent standard is very great, so we should make sure it is designed with the future in mind, with computational devices in mind, with transmission schemes included in its parameters, and with inherent hooks to proprietary electronics not in our benefit. I am submitting two short technical attachments about what CIF should include. These have been drafted by my colleagues at MIT and they are too complex to discuss in this hearing.

What a properly designed CIF can do is permit a family of standards for the different media to evolve, downward compatible to existing video and vision systems which will not go away for a long time despite the introduction of the best high-resolution systems, and upward compatible to systems not yet invented. This will take some

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more R&D, and more time, but there should be no rush to do things wrong.

And, finally, I have proposal to handle what has amounted to blackmail by the EC and Japan: if we don't accept one of their production standards as the single worldwide standard then they will give us two!

7. If any production standard is adopted that is incompatible with our needs (and two would then be better than one bad one) we will put our efforts into display and transmission instead. Our displays will accept anything, including future very high-definition. We can escalate too.

The point will be taken in future negotiations that there is no profit in forcing systems through the CCIR standards process from the top down, because the market will develop from the bottom up. Using computer technology building a multiple standards receiver is not only a good idea, it is the only way to go because there always will be multiple standards. We can short-circuit the nonsensical discussions that go on in the standards bodies over the number of lines, pixels per line, shape of the pixel, & etc. by making clear that there is no resolution to the problem on the production end, only on the customer end. Then they can design all the throwaway systems they want.

Thank you.

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Common Image Format

COMMON IMAGE FORMAT can be defined in many ways, each of which implies an image representation. It is important that the adoption of a CIF not put us on a path of premature high-resolution system development. Though it was suggested at the CCIR Extraordinary Meeting that this could be an interim solution towards the goal of a single worldwide HDTV standard, it must be recognized that it may become a *de facto* standard in itself. The definition of CIF therefore should contain a desired time frame over which it would "work" (e.g. at least 50 years), implying that the format will not be fixed and rigid, but will anticipate reasonable changes in technology.

We suggest that a format can be defined based on transformations of the input video data stream which have the following features:

1. **Inherent Data Compression.** The format should be usable with various data rates and in various systems and hierarchies of systems where different numbers of bits are allocated to each component of the representation depending upon storage and transmission channel constraints.

2. **Variable Spatial and Temporal Resolution.** It is essential that a new image representation allow ready and simple transcoding between diverse display systems and a broad variety of input systems (cameras and media). For example, film and existing television systems should be capable of providing contribution-quality material to any new television system. Further, the representation should require minimal computation and storage on the receiving end.

3. **Extensibility.** An image representation should allow for the invention of new cameras and image recording technologies that directly capture motion information, [illegible]-dimensional data, and production information such as foreground/background contents and camera motion. This data should be incorporated into the architecture of the common image format.

4. **Interconnection.** The format should anticipate television transmission and production in computer networked systems, carriage on digital and analog fiber optic and coaxial-cable switched networks, as well as broadcasting modes. The CIF should therefore be amenable to digital encoding with error correction and analog modulation compatible with existing and transitional over-the-air and cable systems. Work should proceed in tandem with standards-making for enhanced terrestrial TV systems, digital CATV, fiber-based Broadband ISDN SONET interfaces, asynchronous transfer mode (ATM) fast-packet switches, and metropolitan-area fiber networks such as IEEE 802.6.

5. Error Tolerance/Graceful Degradation. The format should anticipate imperfect channels and media and allow for allocation of error correction codes differentially to more or less significant components of the signal. In addition, uncorrected errors should have minimal effect on picture quality.

6. Flexible sidechannels. This is a capability for future uses and applications, including those not anticipated today. The data envelope at a minimum should include pointers to author and copyright information, copy-protection codes, nonlinearity correction factors, compression and transformation algorithms, etc. It is noteworthy that B-ISDN ATM and SONET proposals being discussed at the CCITT have such pointer cells inherent in their frame and envelope structure.

7. Multiple and Simultaneous display. This concept requires further investigation since it could drive the solution of a CIF in unreasonable directions. An image format might allow for simultaneous display of material derived from diverse and seemingly incompatible television systems. This could include "window systems" that show PAL, NTSC, and higher definition video each in a separate window, on the same screen. Alternatively, such image merger could occur prior to transmission, storage, or display, as appropriate.

Common Data Rate

We recognize that a new television format should be usable on existing and potential (or anticipated) recording and transmission facilities. This includes analog media, CCIR 601 recording equipment, higher bandwidth extensions of 601, digital channels in the telecommunications PCM hierarchy (DS-3, H_4 and up), and future data recorders.

Fiber-based broadband fast-packet-switched and TDM networks may be an important part of the high-resolution distribution environment in the not too distant future. Though this will certainly come for contribution and program interchange before fiber-to-the-home is prevalent, it cannot be ignored in determing the relationships between CIF and CDR. It is therefore more important that study be devoted to determining the likely data rates and their linkages to data formats via particular media, than to establish a single data rate *a priori* for only select media, such as tape drives.

Bernd Girod
Andrew Lippman
Suzanne Neil
Richard Solomon
David Staelin
MIT, May 26, 1989

Commonality in TV Formats

Introduction

In the wake of the failure to achieve a worldwide production/program-interchange standard, attention has been concentrated on finding agreement on as many parameters as possible in the hope that this would provide some of the advantages allegedly associated with a common production standard. Even if agreement could be reached on camera scanning parameters and data rates, it would not greatly alleviate the undesirable extra cost and inconvenience associated with multiple standards. In order to make progress in this matter, it is necessary to clarify what is wrong with today's system, what are likely to be the main problems with the various proposals now on the table, what features are most desirable in a new system, and what properties are required in a system that has some chance to be adopted. In doing this, it is absolutely essential that we free ourselves of ideas and approaches based on the now-obsolete technology that was available when current standards were set. We are well into a true technological revolution that is putting microprocessers into practically every electrical appliance. *Complexity in signal processing no longer equates with high cost.* On the contrary, failure to take advantage of modern electronics technology will guarantee both high cost and low performance. Finally, if we have learned anything from experience, it is to allow for some flexibility so that the new systems can be improved over time.

Another factor that must be considered is that analog transmission is not about to die. Over-the-air transmission is by far the cheapest way to deliver broadband signals to the home, and is likely to remain so for a long time. The key to making HDTV a success in the US is the ability to deliver near studio-quality pictures to the home using today's terrestrial channels. This problem is so important and so difficult that its solution *must* drive all other standards decisions. While entirely digital transmission may be suitable for fiber, DBS, and cable (although this is not a sure thing for *any* of these media), over-the-air transmission requires a soft threshold. It appears that a hybrid analog/digital modulation method may be a good solution.

Television's Tower of Babylon

We have never had worldwide standards in television. The best chance to achieve this apparently desirable situation was in 1965, when Europe adopted PAL and SECAM instead of NTSC. None of these systems is clearly superior to the others; the 1965 decisions were primarily protectionist. All three systems now exist in many variants, which is a nuisance, is responsible for extra cost, and results in quality loss in transcoding. The situation became even worse with the advent of tape recording and DBS, since there are even more modulation schemes used in these media.

Today's bewildering array of formats will not automatically disappear with the advent of HDTV; it is likely to get worse, since the desire to dominate markets is still with us, and the need to adapt the format to the specific properties of the various media, now including digital channels, is still present. Given the enormous investment in today's equipment, and the consequent need to transcode HDTV formats into today's standards for many years to come, the cost and quality of transcoding must be carefully considered in new system proposals. Note that the critical transcoding point is between the international exchange format and the transmission formats used in the various countries and various media. Since these transcoders will never be made in very large quantities, we cannot rely on mass production to make them cheap. We must choose a system design that inherently provides inexpensive transcoding at this point in the distribution system. However, transcoding from transmission format to display format, in receivers that will be made by the millions, can be very complex without being very expensive.

It is no longer an advantage to have a common standard for all purposes throughout the world. It is actually a disadvantage, since we now know that we can achieve better quality, for whatever channel capacity is available, by divorcing camera and display standards from transmission standards. It is also desirable to be able to optimize transmission formats for the various media to be used.

The Search for Commonality

If transcoding were free and perfect, there would be no need for standards at all. Transcoding must therefore be a key consideration in all standards decisions. It is temporal interpolation that prevents easy transcoding today. Therefore, agreement on spatial parameters is not very helpful. In the light of the desirability to have flexibility for further improvement, contriving image parameters for standardizing imaging chips is besides the point. Likewise, standardizing data rates does not deal with the real problem. When and if we have broadband ISDN or its equivalent, the systems will be intelligent enough to deal with a variety of rates.

Commonality is also required for non-television applications, and some of these may have special requirements. For example, 'square pixels' are demanded by the computer-graphics community, although this is not very important in television. However, there is unquestionably a convergence between television and computer technology, and computer technology is the path to a wide range of possible applications other than entertainment TV as we know it today. A great range of products and services that may make contributions to the economy may come out of this convergence. This may include medical, industrial, educational, military, and financial applications. Friendliness to the computer environment should therefore be incorporated to the greatest possible extent provided that it does not add significant extra cost to the main application, which is likely to be entertainment for many years to come.

The Four Kinds of Standards

There are two papers attached that were distributed at NAB. In wfs68, we show a diagram of a universal television system. There can be little argument about much of this diagram, as it primarily illustrates what we have now and what we must have in order to produce, distribute, and display TV programs. What is different in this diagram is that we have tried to indicate where the interfaces should be for the highest efficiency. This division shows that there are four types of standards to be considered — production, (international) exchange, transmission, and display. A short discussion calls attention to the desired characteristics of each. The most important point is that transmission and exchange standards need not (in fact, should not) be raster-scanned video signals, while production and display standards should.

Transmission Standards are the Key: *The Common Element Can Be in the Frequency Domain.*

The transmission standard is technically the most difficult, since we are trying to deliver maximum quality in a channel of limited capacity that usually has serious defects such as multipath, noise, and interference. In ATRP-T-97, we propose a transmission scheme — actually a family of schemes — that permits optimization for channel characteristics and features very easy transcoding one to the other. These systems have been successfully demonstrated by computer simulation.

The key element in this scheme is that *commonality is achieved in the spatiotemporal frequency domain, and not in the spatial domain* that corresponds to the focal plane of a camera or the face of a CRT. The general idea is that the spectrum of a normal video signal (that may come from a camera or postproduction system, for example) is divided into components by a bank of 3-dimensional band-pass filters. A basic frequency component is proposed of dimensions 144x256x12; i.e., 144 samples/picture height, 256 samples/picture width, and 12 frames/sec in the 3-D frequency domain. (These numbers achieve a 16x9 aspect ratio with square pixels.) The components are transmitted sequentially through the channel (at baseband) in packages representing a nominal 1/12-second interval. By stacking up such components, arbitrarily high spatial and temporal resolution can be achieved. For the highest quality within a given channel capacity, adaptive modulation and adaptive selection of subband components on a block-by-block basis can be used. A normal video signal is produced at the receiving end by using an inverse filter bank. By altering the duration of the 1/12-sec periods a few percent, off-line transcoding to/from 24, 50, 59.94, and 60-fps formats can be done using integral interpolation or decimation ratios. (2, 4, 5, 5 in these cases.)

The International Exchange Standard

To facilitate transcoding into various transmission formats, the exchange standard can be of the same nature. *Transcoding can therefore be accomplished without using either spatial or temporal interpolation.* All that is required is a 1/12-sec frame store and logic circuitry to repack the data that is to be preserved. Typically, the exchange standard (which can also be a family) would have higher quality, which means that some components are omitted or assigned a lower CNR in the particular transmission format.

Production and Display Formats

The need for international agreement on production standards is very much less than for exchange standards, since the former primarily constitute a convenience for program producers and manufacturers. The latter affects international trade in programs. Those involved in production may agree among themselves if they feel the need. Actually, the march of digital technology is likely to make such agreement less and less important as time goes by. It is highly likely that the postproduction systems of the future will be entirely digital and programmable and therefore will be able to deal with a wide variety of input sources.

Standardization of display formats is highly undesirable. This should be left entirely to display manufacturers. The higher the line and frame rate, the better the quality. This is a good way to separate low-cost and high-cost receivers. If display rates were frozen, as is required to make the multiport scheme useful, it would greatly inhibit the growth of advanced television systems and particularly would make much more difficult the interconnection of HDTV receivers with other products and communication lines.

W.F.Schreiber

May 18, 1989

High-Definition Systems in the 1990s: Open Architecture & Computational Video

by Andrew Lippman,
Associate Director,
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HIGH DEFINITION DISPLAYS will introduce large scale computing into our homes and daily lives in the next few decades. But, contrary to popular assumption, HDTV is not an issue of the number of lines on a screen. Instead, the implementation of high-definition systems is much more complicated; it postulates a new architecture and a generation of video where shooting, processing, distribution, storage, and viewing of moving images each will require different standards optimized for specific situations. Each standard will interconnect through an interface specification, not because each element of the system have the same line rate, but because they will be designed to facilitate interconnection.

We propose that rather than view television as a something akin to a light bulb that must fit a standard socket, we can define a video standard the way we define a computer language. A video signal may be displayable by any system, not because it contains the right number of scan lines, but because a receiver or given production system can understand or interpret the signal and process it.

The basic defect in all the advanced and higher definition television approaches so far — NHK's 1125/60 system, the similar 1250/50 designs of the European Eureka consortium, and the FCC's Advanced Television proceedings — is that all focus on lines, not video architectures.

HDTV is about a new wave of computer appliances. Higher-definition displays for TV are only one aspect of these appliances, which inherently must be digital if only to cope with the difficulties of wideband transmission. Computer displays also will require better definition. The two imaging disciplines — television and computation — are merging, so future high-definition appliances will be programmable (in the computer sense), and a new architecture can be designed to receive any standard or communications service yet to be invented.

The current debate has highlighted two points:

The first is the notion that the **actual resolution on the screen may be independent of the scanning standard.** While computer data bases are commonly processed at higher resolution than the actual display, this separation is new to television. With an open architecture approach, we propose a system where the television image is divorced from the screen resolution or aspect ratio. The receiver maps the incoming signal to an internal format that may be displayed at a variety of resolutions and on a variety of devices, including printers.

Second, we have **the notion of a "production system" distinct from a "delivery system."** While normal NTSC television is shot with NTSC cameras, processed on NTSC equipment, and delivered through NTSC channels, HDTV is generally considered as having a production standard that is only loosely related to the actual delivery system.

With an open architecture for the high-resolution display systems we have a chance to re-evaluate how spectrum is used, and also to choose the best methods for each element of the system. It also means we can define a new way of setting standards for television by building on several decades of experience accumulated in the design of equally complex computer systems.

During the lifetime of the OAR design many different production and distribution standards will be used, and a receiver should be designed to interface to all of them efficiently. In addition, the concept of a transmission system to the ultimate viewer should be separate from the delivery system between nodes on a network, the delivery system is separate because in today's technology it assumes transfer of stored images, while the production system creates an intermediate vehicle which through "post-production" is used to make the stored image for distribution. Each of these has different parameters, requirements, and image definition characteristics.

The Meanings of "Open"

THE OAR DEFINES THE BASIC BUILDING BLOCKS of imaging systems so that interface problems between the elements of production, delivery and display are at a minimum, while utility, growth potential, and new entrepreneurial opportunities are maximized.

Open" does not mean that the Open Architecture Receiver (OAR) itself must be a standard. And, as with IBM's Microchannel Architecture or Apple's Macintosh interface, OAR does not mean that there can be no proprietary elements of the receiver, thereby inhibiting manufacturers and software providers from adding unique value.

The FCC's myopic and limited approach to the problem of future terrestrial television is, in fact, doing more to further the course of Open Architecture than if the FCC had claimed jurisdiction over all forms of video delivery, and attempted to set a new set of universal standards. By specifically limiting themselves to over-the-air terrestrial transmission, the FCC has insured that different systems will be implemented — for cable, VCRs and videodisks, theatrical display, and perhaps telco fiber.

There is no universally accepted definition of the term "high definition." Perceived picture quality should depend on different image densities for different applications and program content, different screen sizes and aspect ratios, and different viewing distances and viewing conditions. We don't need the same number of lines or pixels for a 5-inch screen viewed 2 feet from the kitchen counter as for a 10-foot screen viewed in a small auditorium; a 25-inch screen on your desk used for graphic design may need a higher density of lines, as well as a different scan rate and method of scanning, than a 25-inch screen viewed from the living room couch for a sitcom. In a darkened theater, electronic high-definition displays may require totally different parameters than a large screen in a small living room with ambient light.

Experience over the past, almost 100 years, of the moving image has demonstrated that different uses will require different high-definition displays. Terminal display standards need not be tightly connected to the originating signal as in the past, but that doesn't mean there should be no relationship between the various standards.

Furthermore, the reality of multiple video systems and standards in the coming years is insured just by recent events. For example, at least fourteen systems for advanced television delivery have been presented to the FCC's ATV advisory panel, and there is no guarantee that they will choose any one of them. Instead, they may choose a set, or merge characteristics from several proposals. Europe and Japan have independently developed both production and delivery systems uniquely suited to their own political and technical environment. In Japan there are now two contenders: the incompatible 1125-line HDTV satellite system, and an intermediate proposal compatible with NTSC.

The result of this unhappy situation is the fact that in the near-term, there is likely to exist in the world no fewer than three television production standards (four, including 35mm film), and at least three or four mutually incompatible delivery systems. it may well be that as television systems evolve, the seeming "bug" that more than one standard will exist internationally can be turned into a feature, both throughout the world and within the U.S.

An OAR TV will display any standard within the basic raw computing constraint embedded in the system, and can even show more than one television program at a time, and on the same screen. If the signal gets to your antenna, it will get to your screen.

OAR goes further than access. Like the movies, where some are wide screen, some are 70mm, some are 3-D, and some are black-and-white, television programmers can now flourish in an environment where the system itself is fair ground for growth and competition. Exclusive access to an audience, once the basis for network programs, is replaced by breadth.

Taken to an extreme, there is no reason why a channel could not be dynamically alternated between one high definition gala sporting event and three simultaneous newscasts, each providing a slightly different perspective. Content can determine fidelity, on a moment-to-moment basis.

Television Paradigms

IF THE FCC HAD ADJUDICATED all television, they could have stopped the OAR concept, but they chose to ignore the macro problem for a near-term micro approach, consistent with their rather narrow view that television is fundamentally an over-the-air, broadcast network phenomenon. Nevertheless, in the U.S., each future receiver will have to incorporate at least the existing NTSC standard and whatever advanced TV terrestrial broadcast standard may be chosen by the FCC, plus new alternative media standards as they evolve in the free market.

A more realistic scenario would have been for the Federal Government to recognize that advanced TV implied a new architecture where standards, receivers, and production technology would evolve, instead of an initial static solution requiring "kludges" and black boxes for each incremental future change. That view would have gotten us to OAR more directly, without the FCC necessarily mandating anything for non-terrestrial media. Instead, the current debate attempts to mirror the first 60 years of TV history even though the basic parameters have been radically changed in the past decade or so.

From the earliest days when mechanical TV evolved into electronic devices, through the bitter fights over color TV here and in Europe through the 1960s, standards makers counted lines and defined pixels. Those arguments may have been reasonable when TV began, because:

1) **the entire concept of television was unprecedented;**

2) **electronics was inherently hardwired and expensive;**

3) **television was seen as a relatively static medium,** with a small range of options for viewing distance, screen size, and general utility; and,

4) **there were no alternative delivery mechanisms** to the over-the-air medium.

Today's television paradigm was based on the two driving models of the 1930s:

1) **audio radio broadcasting** (itself a new technology at the time) which then was more parsimonious in the use of spectrum; and,

2) **wireline telecommunication systems** which called for tight coupling between terminal equipment and the network.

These models for systems no longer hold, and there is no reason why future television systems have to follow this path; telephone networks and computer systems have broken the mold and high-definition displays will also.

Half the Set Today is in the Studio

From the 1930s to the 1950s, television taxed electrical engineers' abilities to design wideband circuits and displays. Video storage did not exist. The goal was to launch the medium with the least expensive receiver possible, and this was achieved by quite literally including a great deal of the receiver's components in the transmitter. This was reasonable since even today there are only about 1300 terrestrial transmitting stations in the U..S. but over 140 million receivers in the home. The bulk of the expense was skewed toward the broadcaster, and broadcasting costs were reduced by using the transmission format within the studio as well.

The paradigm for television, in many respects, emulated the spinning wheels of telex machines (or TV's precursor, the Nipkow disk) which had to synchronize with an identical machine on the far end, in realtime, when systems and networks had no processing features nor storage capabilities. This lack of distributed processing power was why half the "system" had to be at the station.

However, this created other problems:

1) NTSC transmitted signals waste spectrum;

and, as video evolved, the new media — every VCR, videodisk player, cable decoder, satellite dish, and home computer — effectively became "local" transmitters so,

2) home component costs proportionately increase.

NTSC uses only about 65-75% of the temporal interval of the channel, 70% of the dynamic range, and furthermore is susceptible to interference and multipath distortion in the channel. Thus the system or opportunity costs for alternative channel uses, and the expense for the consumer has actually been increased over the long run by the NTSC design.

By making a receiver simple to connect to a broadcast transmitter, it became proportionately more difficult to connect to anything else. No longer is television simply a matter of designing an optimal connection between 1300 transmitters and many million receivers, today it is an issue of connections between all receivers and all existing and likely signal originators. Yet, most proposals for HDTV today still look like NTSC or PAL or SECAM; the major inefficiencies are still present with the NHK and Eureka systems.

Signal processing electronics in today's receivers cost between 10% and 30% of the total package; the bulk of the cost of the receiver is in the display and its associated drivers, and even these are optimized by high-volume production and commonalty between units. Thus the cost of added electronics in the receiver may be overstated; the cost of omitting them, however, is high.

If we include signal processing in the receiver we can design a total television system with a new definition of a broadcast standard in mind. In particular, we can broaden the definition of a standard to be a set of signals which are reasonably simple to derive from a related family of production standards; each transmitted signal may not be identical, but optimized for the particular channel which it passes through. A standard in this definition looks more like a computer language. While identity is no more desirable than "object code" congruence, the language ought to be interpretable in several realizations. The notion of a "Friendly Family of Standards"* is akin to a language definition.

Since computer systems commonly operate at scanning rates above normal consumer television systems and there is no standard scan rate for such systems, this is the best way for television to become integrated with computer displays.

Current trends in international standards for digital image representations envision retrieval of moving images from local storage media or communications lines. These incorporate representational attributes that allow some manipulation of the image, other than simple frame selection. The ultimate convergence of computer representations of moving images with that of conventional television is inevitable. As computer graphics becomes more realistic, and video images become more amenable to computer processing and alteration. HDTV should advance this interaction even further.

Computational TV

MOST PROPOSED HDTV TRANSMISSION systems do not broadcast significantly more information than existing television. By virtue of better understanding of image processing techniques and digital compression, we can use one television channel to contain more information than we could in 1946, but not by a factor of five.

There is much that can be done to improve television besides simply doubling the number of lines on the screen. We can eliminate ghosts, we can enlarge the display, we can add viewer options and program choices, and we can electronically augment the signal to make it seem sharper or to minimize the perception of scanning lines by the viewer.

A change in television has already begun with so-called "intermediate digital" TVs (IDTV). IDTVs digitally translate an image onto a higher definition scanning system. So, it will not be long before the computer *qua* TV will be the receiver, whether the broadcaster is delivering NTSC, 1125, 1250, 1375, or any other type of signal.

From a design architecture perspective, the OAR boils down to whether the computer program that decodes ABC resides in read-only memory (ROM), or in volatile RAM — whether you add a new module or box, or add new computer instructions, should you later decide to do so. There are many reasons to choose the RAM option, and precious few in favor of the ROM. The main one is if we turn programmability of the RAM into a feature, rather than cast it solely as a cost, we allow newcomers to invent uses for it. So it was when Software Arts invented VisiCalc for the Apple II turning that machine from a hacker's toy to a powerful business tool, and launching an industry, to boot.

We are at precisely the wrong point on the learning curve of either TV use or TV technology to fix our goals. We are experimenting today with new forms of communication, new aspects of diversity, new ideas in displays, and new ways to add computing to television.

The Open Architecture Receiver

A SYSTEM THAT FUNCTIONS BOTH as a video workstation and an HDTV receiver capable of handling multiple delivery systems ought to have the following characteristics:

- **Inter-compatible:** It should process and display video at a variety of resolutions that allow for support of disparate delivery and production systems that are in common use or are envisioned;

- **Computer-able:** It should allow for video representations that integrate smoothly and seamlessly with computer-generated images and data bases;

- **It should pre-sage a future television scenario** where actual scan rates and display systems are independent of the manner in which the images were originally obtained.

- **It should anticipate growth in the number of signals** it can accept and the particular encoding of each of them.

The high-definition OAR can serve equally well for a workstation/personal computer and a consumer HDTV receiver. They would be identical in their basic design and differ only in the specific components included in each — the receiver will be readily upgradable to become a workstation and the workstation incorporates video as a display and processing "data-type."

As an HDTV receiver, it contains an "open" bus that carries display information. A broad variety of general-purpose and application-dependent modules can be attached to this bus, though this does not imply that the owner of the set would have to perform any maintenance activities, a rather absurd strawman argument often used to confuse open architecture with physically "open" boxes with high-voltage electronics. The OAR is not dangerous!

These modules provide a ready interface to a variety of television distribution systems or add workstation functions. But the bus being "open" does not mean that proprietary modules cannot be designed for attachment, nor that one manufacturer may not be able to create some manufacturing or design advantage over others. As with PCs and other computer architecture, open merely means that the specifications for attachment, for incorporating application programs or other software, and for connection to various video and data distribution systems are public and available to all program providers and manufacturers.

Like programming on television today (or computer applications such as word processors and spreadsheets), the programmer's product will fit on any TV set designed to receive the signal; with open architecture, we extend that concept to more complex ways of delivering video programs, and computer applications, so that more lines of access are possible, and so that the future is not blocked as technology gets better.

Rather than be married to a single standard or use, the open architecture receiver may be one component of a high bandwidth, home or commercial image processing system. Just as a component high-fidelity system can be expanded without discarding the entire system, the open architecture television receiver can grow without inherent obsolescence to accept new displays, new video receivers, or new functional options.

As a personal workstation, it can be configured to suit a similarly broad range of uses. Multiple displays are supported, each at different sizes and resolutions, and an evolving set of image and system processing unit may be included.

Four main design features form the core of the OAR system. Separately, they are significant because they are important directions for the evolution of both workstations and consumer advanced television receivers. Taken together, they provide a basis for a new approach to the integration of video — either digitally represented or analog — and can define a new direction for consumer electronics. These features include:

- **The Open Architecture Receiver itself** — a modular approach to high-definition systems design which is an autonomous image processor for television reception as well as for personal workstation imaging;

- **The Open Architecture Video Bus** — a high bandwidth video interconnection system within the OAR. This is the backbone of the receiver;

- **The Digital Intermediate Format (DIF)** — a specification or standard for the signals that travel on the bus and a hardware implementation of modern image representation and compression algorithms. This is similar to a computer language that can run on any machine as long as certain machine interfaces are standardized;

- **The Hardware Window Manager,** which allows incorporation of multiple, existing and potential image generators with little hardware and software overhead.

TV Set Futures

WE CAN AVOID an *a priori* guess at the number of lines a TV set needs; we can allow each viewer to decide for himself, and each broadcaster to change that number as time and technology advance. The implicit computing in the OAR makes it possible to move the standards issue from an attempt at predicting future viewer tastes and uses of the medium, to allowing a multiplicity of functions (and audiences) to co-exist.

Were TVs to remain hardwired image processors, a rigid standard would perhaps be the only economic solution. But since digital programmability will be required simply to decode virtually any of the proposed transmission systems we can make this feature readily extensible to decode all systems — even those not yet conceived.

OAR is not a costly element. We are not talking about the difference between a PC and a Nintendo game box. OAR is about simplifying the ability to add options and re-programmability. Given that the main cost elements of a television set are, and will remain, the display technology, this modification does not place the OAR out of the range of a household which would consider HDTV in the first place.

There is little experience to guide us in understanding what consumers will buy in the next generation of television equipment, or whether they will buy it at all. Depending on the actual quality of the received signals, research has shown that the advantages of additional lines on the screen may well be lost on most home sets. In fact, it is for this reason that several manufacturers are delaying the introduction of IDTV receivers that process the image within the standard to give the appearance of additional detail.

However, there is no reason to believe that people will be happy to invest in an expensive television set that is part of a staged transition from current television to an "ultimate" system. Did people avoid color TV in the early days solely because it was expensive, or was there some premonition that a better set will be available next year? Do people now withhold their wallets knowing that a better, less costly version of anything is less than a generation away? A closed architecture has as many problems as an open one.

A question is often raised on the overhead of open architecture: If HDTV is a videophile phenomenon, then component television may not be a problem at any cost; yet in a broader arena, one must consider carefully any additional expense not necessary for the real, anticipated functioning of the device. However, we know so little about the uses of TV in the coming years that we cannot afford to preclude very much.

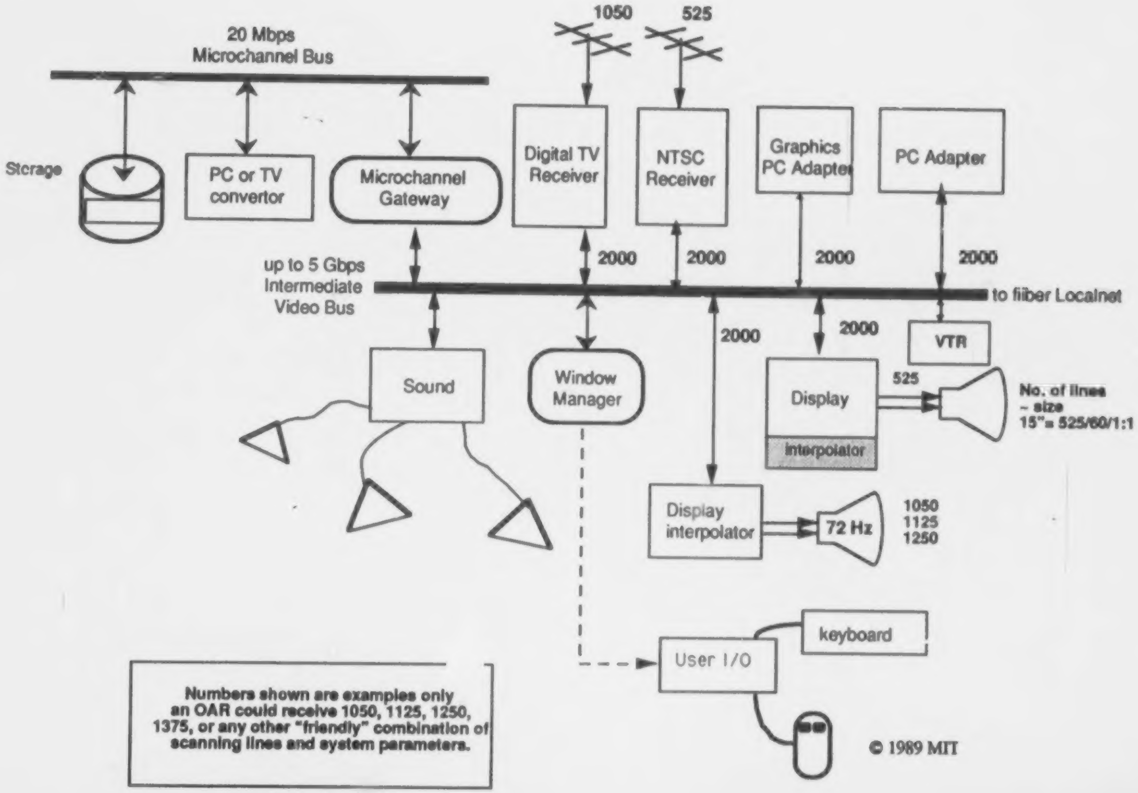
Receiver manufacturers have not endorsed the concept as much as we would have hoped, although internally many are thinking along these lines. For some reason, they appear to think they will do better selling a cheaper product. GM knows otherwise, and most automobile manufacturers use entry-level models only until they gain a foothold in the market and can then sell the more expensive, option-laden models. Witness Hyundai, Toyota and Nissan. Given the inherent expense of HDTV, we assume the manufacturers of TVs are basing their projections on the past business, not the future one.

Broadcasters are loath to allow a variety of standards, both because they have a significant plant investment and because a multiplicity of standards may leave them stuck with the worst. Everyone else has more bandwidth. TV receivers today were designed by broadcasters in a technological era where a simple functional enhancement was quite expensive and television was a more speculative medium. We can develop transmission systems that allow broadcasting a signal so good that the improvement possible through videotape, videodisk, cable, and DBS delivery is negligible.

OAR keeps innovation in the system. There is nothing more stultifying to an industry for a single, long-term standard to be set. Television is fertile enough ground to yield research goals for a few more years.

* Cite Schrieber's paper.

The Open Architecture Receiver


20 Mbps
Microchannel Bus
Storage
PC or TV convertor
Microchannel Gateway
1050
525
Digital TV Receiver
NTSC Receiver
Graphics PC Adapter
PC Adapter
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525
No. of lines
~ size
15"= 525/60/1:1
Display interpolator
72 Hz
1050
1125
1250
User I/O
keyboard

Numbers shown are examples only
an OAR could receive 1050, 1125, 1250,
1375, or any other "friendly" combination of
scanning lines and system parameters.

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Mr. **Hall**. Thank you, Mr. Solomon.

By the way, thank you for the courtesy you extended their staff during their visit to MIT.

The Chair recognizes Mr. Chaseman.

Mr. **Chaseman**. Thank you, Mr. Chairman.

As you know, I'm here in my capacity as Chairman of the Association of Maximum Service Telecasters, or MST. We're an organization of over 260 local television stations.

I'm here to testify some about international production standards but I'll also do my best to put the question of production standards into a broader perspective, to suggest some priorities and to discuss what may be at risk for the United States if we focus only on standards to the exclusion of other considerations unique to this country at this time.

We at MST have been grappling with the issues presented by the impending introduction of HDTV for over a decade. Fifteen years ago, MST successfully urged the United States to seek a new international allocation of radio spectrum for broadcast HDTV. Five years later, nearly 10 years ago, MST was unsuccessful in preventing the FCC from giving up that very allocation.

In 1987, MST, along with the National Association of Broadcasters, staged the first U.S. over-the-air demonstration of HDTV. We transmitted it from WUSA, Channel 9, in northwest Washington to the Cannon House Office Building.

Shortly thereafter, MST led the broadcast industry's successful effort to persuade the FCC to launch a major investigation into HDTV and to preserve, at least temporarily, the remaining portions of the VHF and UHF television bands for HDTV.

The focus of this hearing is on HDTV standards, both production and transmission. And on this important subject, broadcasters have two major goals. First, we believe that development of a broadcast HDTV transmission standard, not a production standard, should be the initial and primary focus of this country's HDTV efforts.

Second, it is essential that the FCC declare clearly, unequivocally and immediately that it intends to permit only a single broadcast HDTV transmission standard.

For this country's communication system as a whole, HDTV is first and foremost a transmission issue. How can we make competitive-quality HDTV available to all the public in a way that preserves and protects their investment in millions of existing NTSC receivers?

How can we move into the new world of HDTV, which the previous four speakers have all talked about, without jeopardizing our uniquely American communications system—the indispensable combination of free information and universal access?

A variety of exciting solutions are now being posed to resolve this difficult dilemma. Which of these widely differing approaches will prevail will not be known for some time, at least—at least—two to three more years, despite all the efforts to expedite the testing process.

But we know enough now to say with certain that HDTV will require more radio spectrum for each television station in this country. Without more spectrum, the American local broadcast system simply will not be able to provide competitive HDTV quality without making present sets obsolete and abandoning current receivers.

No other medium is so constrained: not cable, not video cassettes, not direct broadcast satellites. Yet, no other medium does what we do—provides free and universal service to every part of this country.

Securing additional spectrum for transmission—transmitting—local and regional HDTV and developing a system which can utilize that spectrum simply has to be the centerpiece of the American HDTV effort.

The FCC has tentatively agreed to grant to existing broadcast stations whatever additional spectrum may be available in the current VHF and UHF television bands. But most of the spectrum in these bands is already being used. Providing enough spectrum just to satisfy all existing stations will require the use of innovative and as-yet-unproven transmission systems. Completing the development of such rugged systems will be difficult and expensive at best.

The FCC can spur this development by making its tentative decision on spectrum use final and thus removing the remaining uncertainty as to the availability of the VHF and UHF bands for HDTV.

While transmission is paramount, production, too, is important. We at MST believe that agreement on a single worldwide HDTV production standard at the right time would be highly desirable. We applaud the recent efforts toward this end of the State Department and the Advanced Television Systems Committee, ably led by Jim McKinney.

The Commission must go beyond allocating additional spectrum, however. It must also assure equipment developers and manufacturers now that it will mandate a single HDTV broadcast transmission standard at the appropriate time.

The benefits of standardization are well known. Universal standards promote economies of scale leading to lower prices for consumers. Universal standards lower risk for producers and thus increase incentives to invest. Universal standards facilitate interoperability among users.

Equally well known are the hazards of failing to standardize: market fragmentation, producer aversion, consumer confusion, higher equipment costs and delay.

We believe that the benefits of standardization in the broadcast industry far outweigh the possible detriments, that it is unlikely that a de facto standard will develop without government leadership and highly unlikely that such a standard would develop at all in a reasonable time frame.

The most useful precedent is the now infamous refusal of the FCC to mandate a transmission standard for AM stereo radio. The result has been seven years of confusion and marginal penetration for the new service. During that seven years, AM radio's condition has declined measurably; the patient may now be terminally ill and stereo's medicinal value may be close to zero.

For television broadcasters, HDTV, too, will be a life or death issue. Other media will move ahead, with or without us. Our communications system, and every citizen's investment in it, cannot afford the luxury of a protracted battle over HDTV standards.

We are working hard to facilitate the standards-setting process. The broadcast industry has established and launched, and is funding by itself, the Advanced Television Test Center, of which I'm also the Chairman. The Test Center, in conjunction with the FCC and its HDTV Advisory Committee, the cable industry and equipment manufacturers, will conduct comprehensive multimillion dollar testing and evaluation of all the proposed HDTV systems.

That testing will begin in 1990—or as soon as the system proponents can get their systems into testable hardware. Testing and analysis will take approximately one year, perhaps somewhat longer With the Test Center's data, the FCC's Advisory Committee should be in a position to submit a recommendation to the FCC for a standard in late 1991 or 1992.

But the Commission cannot be passive and simply wait for recommendations. It must declare now that it will adopt a single standard for transmission. Once the industry knows and believes that a single standard will be forthcoming, it is much more likely to share resources and reach an internally negotiated solution.

By taking action early, the Commission will greatly reduce the complexity and risks of the standardization decisions which it cannot responsibly avoid.

Our plea, then, is simply for spectrum and a standard for transmission. We are not requesting a billion dollar grant. We do, however, ask your help, not just to persuade the FCC to work with us on these fronts but to assure all of us that the FCC will have the tools it needs to be effective.

Spectrum allocation and equipment standardization decisions require enormous technical expertise, an expertise which we believe is undervalued at the Commission and which has been starved in recent years in response to extraordinary budgetary pressures.

It will also be vital for the Commission to maintain an active and informed presence and participation in the many tough, arduous international meetings on these subjects. Appropriate dollars for technical staff and international meetings are minimal in the total picture, but crucial to well-informed and truly knowledgeable FCC positions on these fundamental issues.

We are confident that each dollar so expended by the Commission will multiply itself many times over in tax revenues and in increased wealth for the businesses and consumers of this country, as well as superior service to the American public.

In recent weeks, the debate over HDTV has become a debate over America's industrial and foreign trade policies. Increasingly, HDTV is being touted as a cure for an extraordinary variety of this country's economic ailments, including the trade deficit, unemployment, the decline of the consumer electronics industry and competitive encroachments upon the computer and semiconductor industries.

We have real doubts about whether the development and manufacture of any one product in any one industry can possibly be this pivotal to the economy as a whole. But we have no doubt at all about this technology's importance to the future of our uniquely American over-the-air broadcast system.

After more than a decade of hard and successful work attempting to modify the priorities of the foreign-based developers of this new new technology, MST is satisfied that if our broadcast system perishes it will not be the result of oversight or neglect. But unless the government takes appropriate and timely affirmative action with respect to spectrum allocation and transmission standards, we do believe that indiscriminate and thoughtless development of HDTV will have the potential to cripple and eventually kill America's unique local broadcast system.

We urge this subcommittee and Congress to focus on our free and universal local broadcast system as one integral part of the bigger HDTV picture.

Our problems are serious but they are solvable. We stand ready to provide our time, our money and our creativity to work with you. Together we can not only preserve but greatly enhance the value of the local broadcast system to all Americans.

Thank you.

[The prepared statement of Mr. Chaseman follows:]

ORAL TESTIMONY
OF

JOEL CHASEMAN,
CHAIRMAN,
ASSOCIATION OF
MAXIMUM SERVICE
TELECASTERS

BEFORE

HOUSE COMMITTEE
ON SCIENCE, SPACE
AND TECHNOLOGY SUBCOMMITTEE
ON INTERNATIONAL
SCIENTIFIC COOPERATION

ON

HIGH DEFINITION TELEVISION

MAY 31, 1989

Thank you, Mr. Chairman. As you know, I am here in my capacity as Chairman of the Association of Maximum Service Telecasters or MST -- an organization of over 260 local television stations.

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The focus of this hearing is on HDTV standards, both production and transmission. And on this important subject, broadcasters continue to have two major goals. First, we believe that development of a broadcast HDTV transmission standard, not a production standard, should be the initial and primary focus of this country's HDTV efforts. Second, it is essential that the FCC declare clearly, unequivocally and immediately that it intends to permit only a single broadcast HDTV transmission standard.

For this country's communication system as a whole, HDTV is first and foremost a transmission issue: How can we make competitive-quality HDTV available to all the public in a way that preserves and protects their investment in millions of existing NTSC receivers? How can we move into the new world of HDTV without jeopardizing our uniquely

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I am gratified to report that a variety of exciting solutions are now being posed to resolve this difficult dilemma. Which of these widely differing approaches will prevail will not be known for some time, at least two to three more years, despite all our efforts to expedite the testing process.

But we know enough now to say with certainty that HDTV will require more radio spectrum for each television station in this country. Without more spectrum, the American local broadcast system simply will not be able to provide competitive HDTV quality without making present sets obsolete and abandoning current receivers.

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Returning to transmission issues, the Commission must go beyond allocating additional spectrum; it must also assure equipment developers and manufacturers now that it will mandate a single HDTV broadcast transmission standard at the appropriate time.

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But the Commission cannot be passive and simply wait for recommendations. It must declare now that it will adopt a single standard. Once the industry knows and believes that a single standard will be forthcoming, it is much more likely to share resources and reach an internally negotiated solution. By taking action early, the Commission will greatly reduce the complexity and risks of the standardization decisions which it cannot responsibly avoid.

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Mr. **Hall**. Mr. Chaseman, thank you very much; and we do certainly thank you five gentlemen for your time and creativity in your presentation here. I think it's obvious that we have some differences of opinion at the table—Mr. Solomon and Mr. McKinney don't exactly agree right straight down the line. I think that might give rise to some good questions and good answers for the record here.

How far behind—and I direct this to Mr. Lankford—how far behind is the U.S. domestic industry in—in this technology?

Mr. **Lankford**. Well, I think there are two ways to look at it. If you look at just the base technology as demonstrated by the Japanese, certainly they started in 1970, and they've invested a lot of money in it; the Europeans in the Eureka 95 project started just a few years ago.

But there's a more fundamental issue here, however, and that is, where are the underlying technologies? And we maintain that one of the key underlying technologies is the digital technology base that we have in the U.S. We think that the U.S. has a lead in digital technology and there are several key digital technologies that underlie many of the HDTV proposals having to do with digital signal processing, analog-to-digital conversion, memory, and so forth. And in those areas, the U.S. is generally acknowledged to be a leader.

So if you look at the television industry and the application of technology to television and HDTV itself, one could argue that the Japanese have a head start on us. But if you look at the important technologies that will lead this industry into the 21st century, we think the U.S. is at least at parity and probably ahead of both the Japanese and the Europeans in terms of digital technology and, therefore, we have reason to believe that we can make a strong showing in this industry.

Mr. **Hall**. I think each of you have mentioned the participation by this government—particularly Mr. Phillips, I think, in his recommendation set out two points at least. The first was the temporary institute and; second, encourage Congress to press forward with efforts to stimulate ongoing work such as that proposed by DARPA in the high resolution display area. And then went on to talk about while exemptions from antitrust regulations, specialized tax credits, and even low interest matched financing under particular circumstances might be appropriate.

Each of you, or two—at least two of you—have said that you are not in favor of direct subsidies. Actually, the competition you face, and particularly Japan, you're facing governments that have direct and obvious and copious subsidies.

Why is it that you—and I don't see a lot of difference in a tax credit and a direct subsidy because a tax credit's worth about as much to you as a direct subsidy.

Enlarge, Mr. Phillips, if you would, on—on your two recommendations.

Mr. **Phillips**. Thank you, Mr. Chairman.

The notion is that, indeed, the industries which the CCTU represents fully recognize the matched funding and availability often of unlimited funding for research and development efforts in Japan made available by MITI and the efficiencies which that leads to, from a competitive standpoint in eliminating so many of the perhaps redundant efforts that we're confronted with here.

The reason for the recommendation that this go forward in the form of either tax credits or matched funds which, by the way, I believe is being considered by other committees of Congress as well, is that the history of direct subsidies has not resulted in optimal results—or, at least, I should say, timely results. By looking at these efforts in the context of either guaranteed matched funds or tax credits, I believe, or at least the intent of the suggestion was to imply that more focused scrutiny could be placed upon the disbursement of funds against particular details of the effort rather than simply saying, "we're going to allocate X dollars for the purpose of HDTV", and then not have a feedback mechanism for directing those financial resources to particular areas of the technology in which we may enjoy specific advantages over offshore players—particularly, I believe I focused in the testimony on this area of active matrix displays, which seems to be one of the most promising areas and certainly one which is going to have the greatest degree of spin-off value.

Hope is that from a defense standpoint, certainly in the financial services industry as well, there's going to be a great need for the representation of information in high resolution forms which we don't have today using traditional CRT technologies, and that we might see faster and more efficient spin-offs from the overall subject of high definition technology if we are going to focus on specific areas rather tha simply saying, "all right, here's a pot of money, go to it."

Mr. **Hall**. Well, it was interesting in Mr. Lankford's statement that we're talking about a worldwide race for worldwide standards, and he says that race is behind us. That that's a moot situation, if I understood you correctly, that already standards are set in Japan and standards—the European format's quite different to those standards.

In a little bit I'll get back to asking that but we have others here, and I'm also interested in—well, I haven't heard anything said about the Soviet role in standard-setting and I'd be interested in hearing your statements on that.

At this time I recognize the gentleman from California, Mr. Packard.

Mr. **Packard**. Thank you, Mr. Chairman.

It's interesting that we do have different points of view among what we consider the experts on the standard-setting process and the timing. Timing is certainly an area that I think is critical, that we have some kind of consensus.

Mr. Chaseman, you indicated that a single HDTV broadcast transmission standard is critical and that you added that it must be established within an appropriate timeframe. When do you consider the most appropriate time? Do you feel that delay is possible, or is it important that we do it early?

Mr. **Chaseman**. From our point of view, it seems to us that the creative ferment that's been unleashed has been very beneficial. The Zenith AT&T system probably would not have developed the way it has were it not for the time that's been spent on it.

And it seems to me that the longer this can be moved along, with some reasonable restraint and keeping us competitive in the world race, the better off the development of systems will be in accord with some of the other speakers as well who talk about what's being developed in the laboratories and elsewhere.

From our point of view, if the spectrum is reserved and if the United States remains competitive, it looks to this observer as if we're talking about somewhere in the early to mid-1990s. That seems to be a real and doable timetable that comports well with what's happening elsewhere in the world. And it is one that the FCC's Advisory Committee, the Test Center, and others seem to be able to accept. It looks to me like 1992, 1993, somewhere in there.

Mr. Packard. You do see that a five-year—this time-setting plan would not be unacceptable?

Mr. Chaseman. From our point of view, if the spectrum is reserved and if we can compete at that time, that is not an unacceptable timetable if it meets other industries' needs.

Mr. Packard. Do you believe that the—that the production-setting, or standards, ought to be set prior to or—or subsequent to the transmission standards?

Mr. Chaseman. We think a transmission standard must come first. We think logic and science dictates that the transmission standard comes first and that production standards, which in some ways are easier to set, fit into that scheme.

Mr. Packard. Thank you.

Mr. McKinney, why not let the marketplace determine the standards? What's the disadvantages?

Mr. McKinney. Well, I think to a large extent that is exactly what I'm saying, that is, to let the private sector choose the standards, in my view. And it's historically correct for television in the United States, in fact, for all broadcasting in the United States. It is appropriate to let those broadcasters voluntarily select the standards that they wish to operate at. Once that is done, the industries will follow suit and provide equipment at those standards.

The marketplace standard-setting process has failed miserably in the United States. And the best example was given by Mr. Chaseman, and that is AM stereo, where the FCC refused to select a system for AM stereo. And today, AM stereo is floundering in the United States and it's not getting off the ground.

Let me give you, however, an opposite view, and that is television stereo. In the case of television stereo, all of the industry did in fact get together—the cable television industry together with the broadcasting industry, together with the equipment manufacturers. And they unanimously recommended to the FCC a certain standard which the FCC then did protect. And as a result, we have seen television stereo mushroom very rapidly in the United States. So I agree with you on that.

Mr. Packard. Would that, however, leave the ability of, say, Japan or Europe, to exploit the American marketplace in terms of trying to maneuver us into their standard rather than a standard that—that would be most beneficial to the United States, for example?

Mr. McKinney. No, I'm suggesting that the United States process go forward internal to the United States through the FCC, through the FCC Advisory Committee exactly on the track that it's on at this time.

I think what we have to understand, Mr. Packard, if I could suggest, that we do have two different views at this table. And there's a reason that there are two different views at this time, and that is that you have some people on this table who represent television; that is, what we thought high definition television was about two years ago—one year ago.

There has, however, come new players to the field, and that is not the television people—that's Mr. Lankford, Mr. Phillips, and sometimes Mr. Solomon, who are more interested in digital computer telecommunications technology, which is not television technology. And there are those two different views. We must learn to live together and we must learn to go forward creatively. You really do have two different views at the table.

Mr. PACKARD. And how will that impact the standard-setting process? The fact that there are sometimes two competing industries that are looking for the standards to be set to accommodate their industry and in all cases that may not be compatible with each other. What's good for the television industry in terms of standards may be not as good for the computer and other digital industries.

Is there—is there a point where we can pull all that together for the benefit of all of these competing industries?

Mr. MCKINNEY. Indeed, I think that the mechanisms are well in place in the government, both in the laws that control the Department of Commerce, the NTIA, and what it does—NIST is already there—the Federal Communications Commission, which has an absolutely open process; the Department of State, which also has an absolutely open process, and all players should play on that field.

I'm afraid what we have seen of late, however, is the computer industry choosing to play on an absolutely different field and, thus, the AEA proposal to Congress for a $1.35 billion subsidy.

Mr. PACKARD. Mr. Solomon, would you like to comment on that?

Mr. SOLOMON. Yes. First of all, I think it is unfair to say that MIT is new to the field. The Advanced Television Research Program was formed in 1983 and represents basically broadcasters. The Media Lab has a lot of computer interest, of course.

Just as a footnote, both PAL and SECAM derive out of MIT work from the '50s. I don't know if we should be thanked for that or not. Nevertheless, it came out of an MIT spin-off. And if you want to go far enough back, Technocolor was invented at MIT back in 1915. We've been involved all along.

We've been saying all along, and I really shouldn't speak for my colleagues, but they have been saying all along that television, video processing, motion pictures, and computer imaging really belong together, and that in the next generation it would be best to bring it together to cut the cost to everyone.

If we don't, as Mr. Phillips said, we're going to end up with two standards—one standard would be for television, and a standard for the computer industry; and that's not necessary.

It will also mean that television will be handicapped because it will be very difficult, as it is today, to interface with the computer, but the computers won't be handicapped, because digital signal processing will be able to handle full motion.

We might make a comment about that—I'm going to quote from Bill Schreiber's paper that I attached. He points out that we're well into a true technology revolution that's put microprocessors in practically every electrical appliance. I've got one in my watch. Ten years ago, it would be called a "whiz-bang" device. It's got a computer inside of it and it only costs $20.

Complexity and signal processing simply no longer equate with high cost. We can prove that if you wish. In fact, signal processing is found in all the high definition television systems proposed; it's just not used very elegantly. There is no way of having HDTV without using computers in the set, in the camera, in the transmission. We're simply arguing—let's put the standards together and have them make sense; and that can be done under existing mechanisms.

Mr. PACKARD. In your—in your judgment, where do you see the greatest marketplace and perhaps the greatest impact in the United States, in the computer direction of HDTV or in the television direction?

Mr. SOLOMON. It's very, very hard to predict the future, particularly when you change your technology. I think both. There's certainly a big enough market for both.

Mr. PACKARD. And then you—and you feel that that standard—a single standard could accommodate the needs of both industries?

Mr. SOLOMON. No. We're not talking about single standards. That looks at standards in a very old-fashioned way. We're discussing families of standards, as Mr. Lankford said. There are ways of making things compatible without them all being unique for everyone's application.

The concept of the single worldwide standard for anything just doesn't make any sense anymore.

Mr. PACKARD. One of the—certainly one of the messages that have come in our testimonies today is that that—a multiple standard approach would impose additional cost to the consumer, that they would—they would sustain those additional costs.

Mr. SOLOMON. Not necessarily. Indeed, you can show that it would decrease the cost for the consumer. There's no need for the consumer to do the digital signal processing that a computer needs—that could be left out of the TV set. But now we're getting in some very heavy technology that's not easy to explain.

The fact is we use computers and an awful lot of devices today that are a lot cheaper than they were before we used computers. Computers are not expensive. We tend to think of computers as being free because they're so damn cheap.

Mr. PACKARD. Mr.—Mr. McKinney, you had a comment.

Mr. MCKINNEY. Yes, sir. Let me tell you one area where I think great savings could be made on both sides of this debate. We ought to search, if we can, for those points of convergence of technology that can truly be helpful to all players. And I would suggest to you, while computers may be cheap, display devices are not. And display technology is probably the most obvious, in my mind, convergence point of all of the uses of high definition television in its most general respect. And if we can close in on and negotiate a good interception point of that technology, we're going to save tomorrow's television set buyer money, we're going to save tomorrow's computer purchaser money, tomorrow's telecommunications transport and display companies a lot of money, as well as our government and we'll be taking care of Dr. Fields over at DARPA as well.

I caution you, however, to not assume that because all of these devices should have the same display device—the same picture tube, if you will—that that means that television sets ought to be able to compute, or that television sets ought to be able to receive The Washington Post, or that television sets ought to be able to receive the mail. None of that is necessary.

ISDN, when it comes in the United States, when we have that pipeline into the home, will come into a terminal in the basement and off of it will come a pipeline that will go to the living room that will attach to the television set; and off of it will come a pipeline that will go to the den for the computer terminal, and to the kitchen for whatever.

These are marvelous technologies but you need not put everything in the box called a "television set."

Mr. PACKARD. Mr. Chaseman, I—I saw in your response some difference of opinion, perhaps, on the cost that a multiple decision would—would imply for the consumer.

Mr. CHASEMAN. Well, I think there is an occasional oversimplification that takes place, both at panels like this and in the press and elsewhere. And it—it seems to me that when we're looking at high definition television for the consumer as a—as a recipient of news and information and whatever else may be on there—entertainment and sports and so forth—and we think in terms of free and universal, that television set—whatever conformation it may have 10 years from now—probably is not going to substitute for a computer also in the home.

I can recall not too long ago when people in many of the learning institutions and a lot of the trade magazines were saying that computers would be everywhere in the home—and I'm talking now about computers with keyboards and so forth as distinguished from chips. And nobody at that time was writing about fax machines. They were talking about communicating from computer to computer by people sitting down and typing out their messages.

It turned out the American public didn't like that, didn't go for that. And fax machines really took over that part of the industry. Not anticipated.

I can recall when we talk about, and Dr. Solomon mentioned it sometime ago, the leapfrog into the digital age. I can recall when people were talking about moving around in nuclear automobiles. And if the American gasoline engine industry in Detroit had waited for that to develop, we'd be in worse trouble today than we are now because those leapfrogs really don't take place with the rapidity that the people who design them anticipate.

My point is that the television set for HDTV will probably be a large screen, one room occupant referred to by the people in the house. There'll probably not be two or three or four of them in any given household. They will not supplant all the television sets in the home.

And I doubt very much whether the users of computers are going to need either that large screen or going to want to supplant the people who want to watch entertainment and sports while they're computing whatever they're computing.

There is, however, as Mr. McKinney points out, a conjunction in the kind of display devices which may be developed. I learned a lot from Mr. Phillips' presentation. It seems to me that there is a conjunction here that can be pushed and that the marketplace will push.

But to look at one giant machine taking the place of all the others would be a serious error. And I think we have to look into our—into our own thinking about this to make sure of that.

The other point that I have to keep making is that transmission must come first if the American communications system is to be preserved. Now, that's an if. If folks in the Congress and at the Commission and elsewhere do not believe that that's a value that's essential to the American society, then we can take that risk.

Obviously, those of us with a vested interest and with a history in it and with 40 years in broadcasting believe that's a risk we should not take; that we should not take the risk of sacrificing the American system of free universal public communication to whatever the HDTV pot will be at the end of whatever rainbow we sit here in 1989 and predict. We've got to be careful to preserve that value while we move forward in world competition.

Mr. PACKARD. I think the FCC is very anxious to do just that, too, in—in their policymaking.

Mr. CHASEMAN. Well, it may need some help from Congress in the oversight.

Mr. PACKARD. They certainly may.

I am aware, Mr. Chairman, that my time is up. There's still many, many questions that still ought to be asked and I'll defer to my colleagues, but this has been an excellent panel.

Thank you.

Mr. HALL. Thank you, and you can submit any questions, Mr. Packard, that you have.

The Chair recognizes the gentleman from Pennsylvania, Mr. Ritter.

Mr. RITTER. I want to thank the chairman and I want to thank our panelists, and I want to thank the staff. I've been involved in several committee—subcommittee—hearings going back six months, a year, on HDTV, and I think this one has really put some good red meat on the table.

And I was looking over the questions that were prepared by staff and there's such a richness of questions here it's really hard to—to figure out which to present to the panel. But I'd like to, maybe continuing on the track that the gentleman from California was on. Talk about this HDTV as being a kind of tip of the iceberg of what the electronics industry has gone or hasn't gone, and to talk—and some of the testimony that high definition television really can't solve the competitiveness ills of the United States, and I think we can all agree on that.

But starting with Mr. Lankford, just what role does electronics and computer and semiconductor technological competitiveness — what role does that play in our decisions here in the Congress on

HDTV and on the standard-setting process? You as a manufacturer might wish to comment on that.

Mr. **Lankford**. Sure. I think it's a key element. I think, first of all, Mr. McKinney probably defined it as well as I could. This is a very complex process and it's complex for a lot of reasons. One is the issue you just raised, that we have a whole focal point, if you will, for discussion of national competitiveness in some key industries—and that's unusual. It's unlike the television stereo discussion or some of the other standards discussions that have happened before because it is so central to some things that could determine what happens to our economy in the future.

At the same time, we are at a crossroads in what we marketing people call a "market discontinuity." The rules of the game are changing in the telecommunications marketplace and specifically in this aspect of it. And when those market discontinuities occur, both risks and opportunities are created. There are risks for current market players, and that includes many people at this table, including owners of television stations and people that manufacture television sets because a new set of competitive rules will be defined.

And there are opportunities because some people who maybe weren't successful in this market in the past, maybe the American electronics industry, for example, may have some key differentiators that may have value in the new set of rules in the marketplace. And we contend that that could well be the case here because what's happening is this market is transitioning from primarily an analog focus—a rather old-fashioned approach to electronics—to a more digital focus—a place where U.S. industry has a differential advantage.

If you take all of these things together and you look at the import of the standards decision to how this market and industry will develop and then the resulting impact on U.S. electronics competitiveness, you have a very major set of decisions that have to be made and, we would contend, one that needs to be made in a relatively structured and coordinated way. This means it requires leadership, it requires coordination, it requires a view that takes into consideration the strategic aspect of this, and we believe, for instance, that there are risks associated with the standards-setting process.

One of those risks is that if we were to choose to adopt a standard—a production standard —that was particularly well suited to either the Japanese or the European standard proposals we would disadvantage our manufacturers. Now, that needs to be weighed against the value that that may bring to other elements of our economy.

So the standard-setting process has—and let me summarize the point—it has strategic implications in terms of the marketplace and in terms of the development of certain strategic technologies and their evolution in the country.

It also has implications in terms of the evolution of this as a service—high definition television as a service—and how it will ultimately be a focal point for a marriage of a number of key technologies, the computer technology, telecommunications technology, as well as semiconductor technology.

Mr. Ritter. Mr. Phillips, you're writhing away there, do you want to—do you want to comment on that?

Mr. Phillips. Yes, thank you, sir.

The position that we've adopted in relation to the integration of services is that it's highly dependent upon the standard-setting process for technology; but if there's any message that we would want to carry forth to the committee, it's not that we should rush with great haste towards building the super terminal of the future, but rather, that there's more at stake than simply the deterioration or competitive disintermediation of today's telecommunications industry in the United States.

Rather, we're somewhat pragmatic and have studied the willingness of American consumers to purchase, because we represent companies that sell a product that is in this, an unregulated environment and a highly competitive one—information services.

We know that the only services today that consumers are readily desirous of purchasing are entertainment services, much to the chagrin, frankly, of some of our members. There's not an overriding round of applause for home banking. There's not an overriding round of applause for home security, or energy management.

We have, however, studied the economics of transmission under high-speed packets switched environments and made the interesting discovery that if—and it's a big if; the photoelectronic highway into the home exists—that means fiber optics; and we cited a number of problems having to do with depreciation and the overregulation of the telephone industry which thwarts that at present—but if we have that or a similar bandwidth into the home, then the incremental cost of putting basic telephone service, a telephone conversation running at 56 or 64 kilobits a second, on top of a digitized movie, is exceedingly low; three to five percent of the cost of the payload of the existing packets.

Mr. Ritter. That—that—that's—that is, however, on top of the capital cost—

Mr. Phillips. Yes, sir.

Mr. Ritter. —of getting the glass fiber into the home, which is enormous.

Mr. Phillips. Absolutely.

We identified—I didn't go into the details because it—it does get very technical—but we've identified as part of a study funded by the Markel Foundation for Columbia University what is essentially a migration strategy that says—and it's based on the old premise in the telephone industry that 20 percent of the customers provide 80 percent of the revenue and in the broadband data world as well, which is going to be the economic backbone for these high-speed forms of transmission—that the reduction in baseline cost associated with providing broadband facilities into these large information providers—banks, insurance companies, reservation centers, things of that sort—is so significant that the rates should not be reduced 100 percent of the difference.

In other words, if it were reduced 70 percent, then 30 of the remaining 30 percent could be escrowed, essentially, for dealing with that cost, which we recognize is very, very significant. And we also recognize it shouldn't be depreciated over 20 years because the declining cost, (the decelerating cost curve associated with the optoelectronics which basically multiplex these bit streams onto the fibers) is decreasing at an even faster rate.

A footnote here is that this equipment is by and large, once again, made offshore. Nonetheless, it—it is a fact. We recognize that it is a significant cost. We recognize the public policy implications of loading that cost day-one on everyone. We're not suggesting that that happen—but realize that there is—and this addresses the convergence of these two views at the table in a sense—an opportunity to bring this together through the extreme interesting and the wonderful utility of this technology in providing entertainment.

Mr. RITTER. Mr. Chaseman, just—you at the end of your testimony made a comment which I thought was pretty strong.

You said, but unless the government takes appropriate and timely affirmative action with respect to spectrum allocation and transmission standards, we do believe that indiscriminate—indiscriminate—and thoughtless development of HDTV has the potential to cripple and eventually kill America's unique local broadcast system.

Could you elaborate on that just a little bit?

Mr. CHASEMAN. Well, it seems to us that unless a transmission standard comes first and is suitable for the free universal transmission of information, news, access by public—

Mr. RITTER. Comes first before a production standard ?

Mr. CHASEMAN. Yes.

And—well, we think it's tougher. We think it's a tougher question. We think—I agree with whoever at the table said that production standards—I think it was Dr. Solomon—that production standards can be big for the—for the laboratory and for the trade shows and if necessary, for the halls of Congress.

But it's very tough. We—we're finding it's difficult right now to find a transmission standard that's—that's rugged enough to resist interference by others and to—

Mr. RITTER. How can—how can we even begin to think transmission standard —the hearing is about production standard—but how can we even begin to think transmission standard when the Advanced Television Service Committee(—and I guess you're—you're the Chairman of the Advanced Television Test Center that the broadcast and cable and others have put together. And we have Mr. McKinney here.) When we have 24 competing technologies, many of which will not even be functional until sometime later this year or early next year, it seems to me we're nowhere—we're nowhere near a transmission standard, and yet we could conceivably end up with a de facto production standard, could we not? Because people are starting to—to deal with this technology and the available equipment is out there, and you can do some very unique—unique production operations on—on visual images that you could never do with 35 millimeter film.

Mr. CHASEMAN. I think one of the things that's happened—in direct answer to your question—is that today there are those competing interests in both production standard and transmission standards; where four or five years ago when we brought this to the attention both of Congress and to the American public by doing our over-the-air demonstration and by talking with the Japanese, there was really only one. There was really, at that time, only one system proposed by NHK.

Our concern at that time has been consistently represented by us through today, and that is, if there were only one, we're in deep trouble. And not only are we, the broadcasters, but the United States is, and all the competing technologies. As a result of our our efforts along with a few others, we've gotten the Japanese both to be very responsive. They now have an array of systems which they are suggesting. The European Community has developed at least one system. The Russians have a system, as was inferentially pointed out earlier today. And domestically there are forces at work on a variety of systems.

We think that this creative ferment, while it's hardly let a hundred flowers bloom, we think it's very much to the point. And we think that the process is under way—what's interesting to us, Congressman Ritter, is that nobody else financed the Test Center—just the broadcasters. There's no other financial interest involved here. We'd welcome some. But we haven't received any.

But we are working with the FCC to test as ecumenically as possible all these various systems, and we will do so, and hope we get support from others.

But the essence of the point is that the creative ferment has produced for the United States I think two major things: One, flowering of competitive systems which can auger nothing but improvement to the eventual end product. And two, it has stopped a juggernaut.

Mr. RITTER. So you're saying that we do believe that indiscriminate and thoughtless development of HDTV has the potential to cripple and eventually kill America's unique—

Mr. CHASEMAN. Yes.

Mr. RITTER. —~~indiscri~~minate and thoughtless development.

What—what exactly were you referring to?

Mr. CHASEMAN. I'm talking about, number one, the—the early setting of a production standard without consideration of its ability to be transmitted well by the over-the-air broadcast systems of this country.

We think that—if we cannot compete with video cassettes, with cable, with DBS, in the presentation admittedly in the middle to late 1990s and thereafter—if we cannot compete and present an HDTV picture that is discernibly as good as and accepted by the American public as other media, we will not proceed economically because our audiences will splinter even more than they have.

We're willing to accept as much competition as there is out there. We're willing to invest our time, our money, and our creativity in the development of this product.

What we ask is that the priority be there so that the American system can compete in HDTV, in the look of the system, and its ability to be received by the American public—freely and universally.

Because in an information-dependent society—and I agree with the others at the table who have talked about this—it's terribly important, it seems to us, to this country that the 20 to 30 percent who choose not to pay for information, sports, entertainment, access, or *cannot* pay for these things, not be disenfranchised.

Mr. **Ritter**. So would indiscriminate and thoughtless development encompass an attempt by some electronics industry consortium to leapfrog into the digital era and—and gain government sponsorship for that? Is that part of what you're talking about?

Mr. **Chaseman**. There's really—I'm not—this sounds, I suppose, facetious—but I'm not paranoid enough to have focused on individual villains in this scenario. Our concern is that the—

Mr. **Ritter**. Mr. Chaseman, I wanted to make sure that that was not meant—that was not what you meant—

Mr. **Chaseman**. I'd have to plead innocent on that one.

Mr. **Ritter**. Just one last—Mr. McKinney, do you want to—

Mr. **McKinney**. No.

Mr. **Ritter**. —comment on this?

Okay.

Mr. Chairman, I really appreciate the opportunity to sit in with the subcommittee and to take time for questioning; and once again want to commend you and the staff on putting together a truly excellent hearing.

Mr. **Hall**. Thank you, Mr. Ritter.

Because of the vast knowledge here at this table, I think, and because I have one quick question I want to ask and I can't ask one without allowing the other two gentlemen to ask, we'll take another about a three-minute rerun if anyone wants it.

I'd just like to follow up on something that Congressman Packard asked when he asked about letting the production standard be set by the market. Mr. McKinney, you indicated that you'd like to do that.

And Mr. Lankford pointed up that Japan's already established a standard and the European format is quite different to that. There was a time when we could either set the standard or if the standard was set we could reset it. But I think that atrophied away in the early '50s and certainly by the '60s when we lost our, I guess our technical advantage in—in many, many areas or where we were in the process of losing it.

So I guess my question is, where is the market? Is the United States—is this the major market in the world for HDTV?

Mr. **McKinney**. For viewable high definition television , yes, the United States is the major potential market. There is, of course, today, no market. But we are the largest potential market in the world. And people who want to produce high definition television are going to have to satisfy us.

Mr. **Hall**. So short—you want government participation, but I guess we all want it short of a protective, any type of protective thrust that would preclude a consumers market that's acceptable to them and preclude denying the American people a product that's superior to that that we might be producing, and we're already behind.

I guess the question is, if we're already behind Japan and Europe in that they've already launched into this standardization, how do we catch up?

Mr. **McKinney**. Well, I'm not so sure we're that far behind. Let me tell you why I believe that. Certainly not on the production end—which is really the smallest part of it—what will happen in Hollywood and what will happen in the network studios in New

York and Los Angeles. From an economic standpoint, that's a very small piece of the pie. There isn't much money to be made there. There isn't much of an industry to be protected there. I don't think you have to worry a great deal about the production end of the business.

Where the real bucks are, is in selling television sets to the American public, to the 90 million television households in the United States. And when it comes to that, as far as the United States is concerned, we are miles ahead of the rest of the world on a transmission system to the home. We don't have one yet, but we're well ahead of the rest of the world.

Think of poor Europeans who want to see high definition television. They are going to have to buy satellite dishes and down converters, and television sets—three different things. They already have been promised they're going to have to buy two television sets in order to get high definition television finally.

The Japanese are in the same situation. They're going to deliver it by satellite. And the United States will deliver it terrestrially. We'll deliver it by those entities who are today's broadcasters in the United States and they'll be ready by the time the American public is. So I don't think we're in such terrible condition when it comes to the absolute important function, and that is delivery to the home rather than production in the studio.

Mr. HALL. Well, I—I was just using some of your own words, of the panel's words. The question is whether or not we'll take the actions necessary to catch up and seize a leadership role. Obviously, we're behind in the automotive field. We're being outproduced and outsold automotive-wise. And now the Japanese are looking skyward and we're about to cut a deal with them that will give them all of our technology, or much of our technology, in the aviation field. Our textile mills are closed all over this country.

I just wonder—and now we're on computers, telecommunications and semiconductors, And if we're already behind—

Mr. RITTER. Will the—will the gentleman yield on that?

Mr. HALL. I think—I think that you failed to emphasize enough the need for this government to support the research and thrust that we have to have to get competitive. I think we're going to have to be—have to talk a little more plain than—than we have, and either require Japan and some of these other countries to defend their own shores and not have so much money to subsidize their industries, or to start subsidizing our own. I'd like an enlargement on that.

Mr. RITTER. Will the gentleman yield just for a quick point on that?

Mr. HALL. I do yield, sure I do.

Mr. RITTER. I—I want to add my voice to that because I think if you look out there—if you look out there now and you see what's out there, it's Japanese video tape recorders, it's Japanese cameras, it's Japanese, a lot of the transmission technology for most of it, actually, for the satellite transmissions, and they have the opportunity to go pretty quickly into the video tape VCR home market, or certainly the—the tavern for sports events with large screens, and—they can get such a running start here. By the time that we come up with our transmission standard that it would seem to me that whatever happened then, if we weren't working in parallel prior to the development of that—the—the implementation of that standard—we would just buy Japanese equipment right off the shelf.

And I think that's really what a lot of us in the Congress are concerned about. Maybe it is a different concern than—than the focus of the broadcasters because it—it is the aim of the broadcasters to transmit signal but not necessarily where the competitiveness in the manufacturing and the production and the development and the research is going to come from to transmit that signal. And I just wanted to make that point to the gentleman.

Mr. **Hall**. I thank the gentleman for that input. Perhaps we won't act accordingly for the same reason Japan doesn't buy our fighter right off the shelf. They think—and I think it's highly likely that they'll have the technology within three years if—if they really sought to have, because we've never been able to keep a—any type of a scientific secret. The greatest secret in the history of this country is the atom bomb. I think they had it, in what, 2-1/2 years.

So these are things—and Mr. Lankford and Mr. Phillips stated that Commerce ought to take a more active role, and I surely agree to that. I think the man that heads up Commerce over there agrees to that and would give some real leadership in—in that area.

What does the rest of the panel think about that?

Mr. Solomon?

Mr. **Solomon**. Certainly in research and development and in coordination, the government has to take a role. I can't agree more with Mr. Ritter's statement. And I think that we have to separate the problem in two parts. Are we behind? Can we catch up?

We're certainly behind in existing technologies. Look around the room, these are all Japanese cameras, and Japanese microphones, and Japanese recorders.

Are we behind in the future? No, there's a window that's still open. We can catch up for the future if we start working now, and the government's going to have to help. And DARPA is doing a lot to get started but it needs a lot more money to make some contribution.

Craig Fields has made a few comments about the DARPA program. I don't believe they've released any of the information yet on who's getting what. But he has indicated in a way that the free market is working. As Mr. Chaseman said, by opening up the competition in television, some brilliant ideas have appeared—a lot of hardware that's American—so we do have a chance to catch up. But we've got to support that.

Mr. **Hall**. Good.

Mr. **Chaseman**. I'd like to add a voice to that, if I may.

Mr. **Hall**. Yes, sir, Mr. Chaseman.

Mr. **Chaseman**. Yeah, I can recall our president, Wally Jorgenson—MST's president, that president—talking, I guess it must have been eight or nine years ago, to Congress about this impending HDTV crisis. And it was a voice just kind of cast out, and it disappeared. And I—I recall some meetings that I had, and others in this room had, with the Japanese who were developing these systems—again, two, three, four years ago—and persuading that they had to be more flexible.

Some people—I recall a widely quoted statement, that the sets are on the boat. Well, the sets aren't on the boat. Because the FCC and others took the extraordinary step of saying that the United States was determined to get involved in this business of HDTV, and to set some standards for the American marketplace, and to tell all who were interested in invading it, that the United States was now up and running. And I think that's been a remarkable step.

I don't happen to believe that the efforts of other industries to revive the American will in the area of manufacturing and development necessarily is mutually exclusive of broadcasting's desire to preserve the system and to make sure that the American public doesn't have to pay every time it needs basic information, news, or access to its public figures. I don't think those things are mutually exclusive.

I do not think that establishing some priorities, transmission versus production, will slow up the American renaissance in the area of manufacturing and developing an HDTV science and commercial system that works.

I think these things can be working together, and I do believe they are. I think—I don't think we start today. I think we started five years ago. But it's marvelous, frankly, from my point of view, to have a committee of Congress as deeply involved and as interested, and as skillful as this one has been, in bringing together four of the five people on this panel and then eliciting from them the kind of responses you've been able to elicit. I think that's a wonderful testimony to where we now are as distinguished from where we were seven or eight years ago.

Mr. **Hall**. I think it's a tribute also to the staff, Mr. McElyea, who set this in motion.

My three minutes turned into about nine minutes. I now yield to Mr. Packard, if you have further questions.

Mr. **Packard**. I would be just interested in having one sentence from each of you as to what you see as the central message you would like to convey to Congress, and maybe a second sentence as to where you see the five of you as witnesses converging with a consensus.

We understand your differences of points of views but I'd like to know what you see as—together—as important, but also what your central message in one sentence to the Congress would be.

And we'll go right down the list as they are—as appeared on the witness list.

Mr. **McKinney**. Thank you, sir.

I guess since the topic before us here today is standard-setting , my one sentence would be that I think the United States is well positioned today, we're exactly where we ought to be in the international standard-setting process. We have time now to look at our new technologies inside the United States and decide in which directions we wish to move. I think that's a major change from a couple months ago, but I think we're in good position today.

Where do we converge? I would hope that we converge on the issue of display technology. I think it's an extremely important point of convergence that will benefit everyone at this table and every industry that they represent and I would like to see us work hard in that direction. And if there's money to be spent for R&D in the U.S., I think Craig Fields would find that would be a good area to spend it in.

Thank you, sir.

Mr. **Lankford**. I think the strongest message here is that this is a crossroads and this is both an enormous opportunity and risk for the country. We said we were behind, and we are in the application, obviously, of video technology. But the rules of the game are changing and the underlying technologies that will be important to video and audio and consumer electronics in the future are areas where we have strengths. So we have an opportunity to regain a role in these industries, and we have an opportunity to do a great service for the country.

Where we need government help? We need government leadership because this is a very complex problem that involves a lot of constituencies, so we need leadership, and we need risk reduction. American industry has—has exited the consumer electronics business for a lot of reasons, and we need help in order to reduce the risk of reentry—leadership, risk reduction.

If we undertake these things jointly, I think there's enormous opportunity for the country. The standard-setting role is an important element of that leadership, because that allows people like us who make equipment and people who make programs or distribute programs to enter the industry understanding the rules rather than having to guess at what the standard's going to be for production or something else—and that's a big element of risk reduction.

I think there is a great deal of convergence among the panel members relative to display. I also sense an understanding among the panel members of the extreme importance of the standards process itself. It is a non-trivial issue, both in terms of market development and in terms of the strategic positioning of the country in these key technologies.

Mr. **Hall**. Thank you, Mr. Lankford.

Mr. Phillips?

Mr. **Phillips**. Thank you, Mr. Chairman.

Sentence number one: The standard must not, as we proceed, lock out, make it more expensive or more difficult, to transport digital information and the distribution of that information as we proceed in our examination of high definition television.

Sentence number two is that as we clearly converge in opinion, I believe, in stressing the importance of the transport layer standard of having some concept of what that is going to look like before we focus on the standard which is going to determine the rate at which a helical wheel spins in a video recorder, or the rate at which an image is scanned within a Plumicon tube of a television camera. We converge on that point, and I think that we converge on the notion that this has to be viewed very much in a strategic vein and as an opportunity as much as it is a risk.

We see the opportunity in information services, not as discontinuous with the information or the entertainment industry because in the digital world there's no difference between a pattern of bytes representing the Late Show and the pattern of bytes representing a $50 million funds transfer order between two central banks.

Thank you very much.

Mr. HALL. Thank you, Mr. Phillips.

Mr. Solomon?

Mr. SOLOMON. The single message that I would like to see from panels like this and in all the previous hearings is that the United States has decided to take its future in its own hands. In this case, Mr. Lankford said that the rules have changed. We should make it clear that *we* changed the rules, that we're going to have to be dealt with from now on.

The common areas, I think we've all begun to agree on here is that the computer and electronics industry and the broadcasting industry have a lot to give to each other and they can work together. Now it's a matter of will.

Mr. HALL. Thank you, Mr. Solomon.

Mr. Chaseman?

Mr. CHASEMAN. I was struck by Mr. Phillips's comment on the similarity of the two bytes. It seems to me that technologically he's correct; socially and politically, there's an enormous difference in the content. And I think part of what we have to do is keep an eye on that.

I think the best can be the enemy of the good. I think reaching for some illusive technology that's way far out, we're liable to lose our focus on competing at present. We've got to keep working at it. We can't let that pie in the sky of that illusive future technology blind us to where we are today and what we need to do to compete.

I agree with Jim McKinney on display devices. I think we ought to let development continue. And I think we have to keep our eye on the free and universal distribution of information, access to an informed society. And we've got to be very careful that we not require 20 or 30 percent of our people that have to pay for that. That could be a very dangerous future development.

Mr. HALL. Thank you.

Mr. Ritter?

Mr. RITTER. No further questions, Mr. Chairman.

Mr. HALL. All right. We certainly thank this panel. I think this has been one of the really great panels that we've had and you've made a major contribution to the knowledge that this Congress needs. And I hope, Mr. Chaseman, we don't wait two years to act on it again.

Thank you very much. We appreciate you very deeply.

[Whereupon, at 12 o'clock noon, the subcommittee was adjourned.]

APPENDIX

SUBCOMMITTEE ON INTERNATIONAL SCIENTIFIC COOPERATION

Hearing on High Definition Television

The International HDTV Standard-Setting Process and the Role of International Standards on U.S. Competitiveness

May 31, 1989

ADDITIONAL QUESTIONS FOR MR. McKINNEY WITH HIS RESPONSES

1. a) **Is there any need for new or modified legislation related to the HDTV production standard or the production standard-setting process?**

No. The correct statutory process which includes participation by the private sector, Departments of State and Commerce, and the FCC is in place and working properly.

b) **If yes, what should this legislation include?**

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2. **Does Commerce or any other Federal agency need to take a more active role in the HDTV production standard-setting process?**

No. The Department of Commerce, including its National Telecommunications Information Agency (NTIA) is fully participative. I would encourage favorable budgetary treatment for NTIA and for FCC so they can continue to provide necessary resources to their staffs as they continue to play their very important roles in the standard-setting process.

3. **What is the right time for the U.S. to establish a HDTV production standard?**

At a time when the private and public sectors have reached a consensus as to which standard should be established. That date is several years in the future -- probably in the 1992-94 time-frame, at the earliest.

4. **Mr. Phillips stated in his testimony that HDTV production standards should consider broadband communications applications. How should the HDTV production standard interface with broadband, cable and transmission standards?**

The topics are totally different. Production of television programming is unrelated to Mr. Phillips' desire to provide wideband telecommunications services to business users in the United States. (Refer to my closing comments in the main body of my testimony.)

5. **Will a "digital" HDTV standard be developed by the CCIR and how should this standard interface with "digital" computer standards?**

   Yes. The CCIR is working both in the area of analog television and digital equivalence. Also, CCITT will be asked to review our work on "Common Data Rate." However, it should be understood that the United States television industry -- in the short term -- prefers to develop HDTV through analog means. Digital technology is not mature today and probably cannot be broadcast terrestrially or economically to the 90 million television households in the U.S.

6. **Will adopting a "U.S. standard" help the U.S. become competitive in HDTV?**

   Yes, if it is the right standard. No, if it is an effort to simply impose a non-tariff trade barrier against foreign products. (See the main body of my testimony.)

7. **What is the long term cost to the customer of not having a single international HDTV production standard?**

   The initial costs would negatively affect our production community (Hollywood, the television networks, and independent producers). Eventually, equipment costs might increase and higher production costs could result in less diversity of programming at home and a smaller audience, worldwide, for U.S. productions. Bottom-line costs to television viewers is difficult to predict with any certainty.

8. **What has the Soviet role been in the HDTV standard-setting process and are we risking transferring sensitive technology to them?**

   The Soviets find themselves in much the same position the United States is in. They will likely need to transmit HDTV terrestrially rather than by satellite and they will likely purchase production equipment from outside the USSR. I am confident there is no danger of transferring sensitive technology by allowing the USSR to have access to today's analog HDTV equipment.

   We will have to be cautious as we move to develop the more sophisticated display technology of the future. This, of course, will be a matter for careful review by DoD and our intelligence agencies.

   Finally, the USSR is likely to be an ally of the U.S. in future discussions of international production standards unless they are forced to begin development of their own HDTV technology or to buy 50 Hertz equipment from Europe.

June 12, 1989

SUBCOMMITTEE ON INTERNATIONAL SCIENTIFIC COOPERATION

Hearing on High-Definition Television:

The International HDTV Standard-Setting Process and the Role of International Standards on U.S. Competitiveness

May 31, 1989

ADDITIONAL QUESTIONS FOR MR. LANKFORD

1. a) Is there any need for new or modified legislation related to the HDTV production standard or the production standard-setting process?

   b) If yes, what should this legislation include?

2. How will the HDTV production standard chosen impact consumer acceptance (i.e., cost) of HDTV??

3. What is the right time for the U.S. to establish a HDTV production standard?

4. How should the HDTV production standard interface with cable, transmission and satellite broadcast and "digital" computer and telecommunication standards?

5. Would adoption of a "digital" instead of an "analog" HDTV production standard make a difference in the competitiveness of U.S. industry?

6. Will adopting a "U.S. standard" help the U.S. become competitive in HDTV and impact where HDTV's will be developed and manufactured?

7. Will *de facto* production standards be established while the U.S. is trying to make up its mind about a production standard? If so, what will be the impact on manufacturers and consumers of HDTV equipment?

8. What is the long term cost to the customer of not having a single international HDTV production standard?

9. Are the competitiveness and economic concerns of manufacturer's currently adequately represented in the standard-setting process? If no, what changes would you suggest?

10. Mr. McKinney stated in his testimony that the U.S. is now well positioned to set a production standard which meets our needs, do you support this view?

The issue of HDTV standards is a complex one that involves both technical and economic considerations. It is part of a much broader set of very complex issues having to do with the social, strategic, and economic impact of HDTV on our country. Because of the complexity and pervasiveness of this issue, we strongly believe that the federal government should take a strong coordinating and leadership role. This role could be implemented through an "HDTV executive" in the Department of Commerce who would be advised by appropriate representatives from the public and private sector.

1. It is not clear at this stage whether it is desirable for the government to set production standards. This would be a departure from the current situation in motion pictures and television where standards are established by voluntary industry action. The Commerce Department should make a recommendation on this issue as a part of a comprehensive plan that guarantees the public will have access to the highest quality HDTV consistent with market economics.

2. The selection of a production standard could have several potential impacts on consumer acceptance:

- If it did not interface smoothly with the transmission standards it could degrade system quality, thus reducing the attractiveness of HDTV.

- If, by virtue of its technical characteristics, it limited the choice of transmission standards, it could result in the selection of suboptimal transmission standards.

- The selection of a domestic production standard could have an impact on the ease of availability, quality, or timeliness of program material, particularly that of foreign origin.

3. The production standard should be part of a coordinated standards setting process that includes compati~~ble transmission~~ standards. Transmission standards should be set based on objective evaluation of demonstrable systems. The current process established by the FCC, including the testing program, appears appropriate. The standard should be established once the evaluation process is complete.

4. Any production standard must have information content greater than the transmission standard for the "best" medium, and should "smoothly" interface with the various transmission standards. This means, for example, that an interlaced production standard would not be smoothly compatible with a progressively scanned transmission standard. An ideal situation would be a "friendly family" of transmission standards (derived using a systems approach to the selection of HDTV interfaces), each of which would make the best use of the particular medium and would smoothly interface with the production standard and with other members of the "family".

5. The ideal production standard would smoothly interface with the transmission standard(s), provide for a common format interchange with other production standards of other countries, be economical to implement and allow for future improvements. One of these improvements is likely to be end-to-end digital transmission. Objective evaluation against these criteria is probably the appropriate selection process.

6. While it is unclear whether any standard can, in and of itself, establish a long term sustainable competitive advantage, we believe it is true that standards can help to level the playing field initially. The US should select a set of standards that best meets the needs of our unique market. Adoption of a foreign standard could give that country's manufacturers an initial advantage since they will have had experience with the selected standard, could have a volume cost advantage, and may even have products ready to roll immediately.

7. One could argue that there was a de facto production standard in the US when the NHK proposal was the only one on the table. This is no longer the case with many innovative proposals emerging. The critical issue is: How will this be viewed in the overall context of the standards setting process, particularly as related to transmission standards? We believe that standards should be set in a coordinated fashion, and that the early existence of a de facto standard with minimum US application should not become a limiting factor for the overall US standards process.

8. If there were smooth transcoding from one format to another, such as with a common format, there would probably be minimal impact. If this is not the case, then the consumer would be impacted in terms of either availability or technical quality of program material. It is clear by the activities of the Europeans that there will not be a complete single HDTV production standard.

9. The standards process will have a major impact on our ability to successfully implement an indigenous HDTV industry. We believe it is appropriate for equipment and semiconductor manufacturers and transmission service providers to be represented. One possible mode for this represenatation would be an industry advisory committee to the HDTV executive.

10. We disagree with this perspective. It is not rational to establish a production standard in isolation from transmission standards. The US needs to complete the orderly process of standards evaluation, and then make a decision as to a coordinated set of standards.

SUPPLEMENTAL STATEMENT OF KENNETH L. PHILLIPS, CHAIRMAN OF LEGISLATIVE AFFAIRS OF THE COMMITTEE OF CORPORATE TELECOMMUNICATIONS USERS, IN RESPONSE TO "ADDITIONAL QUESTIONS" POSED BY THE SUBCOMMITTEE.

Is there any need for new or modified legislation related to the HDTV production standard, or the production standards setting process?

Yes. Because of the implications of the production standard (which has almost exclusive bearing on the motion picture, television and other entertainment sectors), on the telecommunications transport standard (which effects any number of data communications and information services sectors), legislation should stipulate the importance of the telecommunications transport standard being studied, evaluated, and endorsed prior to the fixing of a production level standard for High Definition Television.

What are the corporate communication applications of HDTV technology and how will this technology impact the competitiveness of U.S. firms?

From a technology perspective, through two channels. Firstly, it is likely that if the HDTV initiative goes forward, significant advances will be made in the area of display technologies for terminal devices. One of the most significant hurdles facing manufacturers of consumer electronics products, and most especially those personal computer manufacturers who seek to offer portable devices, is the display technology employed. Today's display devices are generally not of great resolution, tend to be heavy and fragile, and perhaps most disappointing, consume power at a rate rendering session time, when fed from portable batteries very short. Active matrix high resolution displays using thin film technologies are promising but require further research. Much of this research is likely to come as a result of the potential represented by HDTV.

Secondly, and more importantly from the standpoint of overall U.S. competitiveness, it is important to realize that high definition images, from a telecommunications viewpoint, are indistinguishable from data files, computer generated messages, or even a Beethoven symphony. All are patterns of bits and bytes. What does matter is that the standards set on an international and domestic basis for the networks over which these patterns are to be transported are optimal from the perspective of no one application or format making it increasingly difficult or more expensive to transport another over the same fiber or carrier frequency.

In other words, it is possible that one standard which perhaps has already been demonstrated to be capable of transporting data comprising an unusually good video image could result in significantly more costly methods of transport having to be used in carrying both synchronous and asynchronous streams of data travelling between computers belonging to information service providers and their customers. These costs could be expected to have direct effect over the period of time required for the United States to once again obtain leadership in the Information Age. One CCTU member for example, expects to have a financial relationship with one in every five U.S. households by the end of 1990.

Although the robustness of the demand curve for consumer information services may legitimately be called into question today, it is important to bear in mind that in the telecommunications field 80% of the revenue is generated by 20% of the customers: the large telecommunications users. In addition, with the increased efficiency of display devices and lower transport costs associated with efficient broadband standards, the characteristics of future demand curves for these services will surely alter, opening further competitive opportunities for U.S. firms.

How will the HDTV production standard chosen impact corporate applications of HDTV technology?

Just as is the case in the debate over broadband vs. narrowband ISDN, should the adoption of a single HDTV production standard take place resulting in gross inefficiencies in transport economics, large corporate players will develop their own large-scale networks based upon more cost effective technology and transport.

Highly reminiscent of the "bypass" phenomenon in competitive common carrier markets, the CCTU learned that large users would prefer not to have to go off and construct and operate their own costly networks, but that the implications of these decisions and role of telecommunications is so critical to the product differentiation process in competitive markets, that the costs are low in relation to the opportunity to stimulate new customer relationships.

The magnitude of opportunity for new information products stemming from inexpensive high-resolution display devices is truly unlimited. Fundamental changes in the way financial, educational, medical, and personal data are presented to users could take place. With better display devices, coupled with both declining costs in DRAMS and central processing chips, the day of integrated open architecture receivers moves closer. With it should come information processing devices that not only recognize the cognitive style of the user, but modify the manner in which information is presented to users, depending on which of the four such styles, that we might best call "thinking," "feeling," "sensation" and "intuition" are most dominant in a given information consumer. Today, only 25% of American households (at most) have personal computers. Of those who choose to use home banking, for example, on a nationwide basis 30% abandon the service within six months of subscribing, despite registering a high degree of satisfaction with the service.

High resolution display devices and other potential technology spin-offs from HDTV could move American's use of advanced information technologies out of the category of an expensive and temporary infatuation and into a future in which personal assets are better managed, corporate services more effectively delivered, and the entertainment arts more fully appreciated.

What is the right time for the U.S. to establish a HDTV production standard?

The planning and study process leading up to the establishment of an HDTV standard is sufficiently complex so that it should begin at once. In order for this to go forward most effectively, a temporary commission on HDTV and broadband telecommunications should be established. This commission should be comprised equally of members of the user community, telecommunications carriers, entertainment producers, broadcasters and consumer electronics sectors. In addition, experts from both the private and public governmental research communities should be on board as outlined in the main body of my testimony.

How should the HDTV production standard interface with cable, transmission, satellite broadcast and digital: computer and telecommunications standards?

In the specific case, answers to these questions would comprise a significant percentage of the deliverables produced by the temporary commission addressed above.

Generically, the importance of each of these distribution media must be fully recognized. The HDTV production standard should not be compromised in terms of the ability to efficiently utilize each of the above media, as well as that of fiber optics, yet at the same time, the downside risk is that as a result of not having a common image format separate, isolated transport standards could emerge: one for HDTV entertainment and graphics applications, the other for data and voice telecommunications. This could result in missing a very significant economic opportunity to reduce the cost of both services to U.S. consumers.

Would adoption of a "digital" instead of "analog" HDTV production standard made a difference in the competitiveness of U.S. industry?

Although we have no doubt that it would, production level competitive issues surrounding image quality generally fall well outside of the sphere of issues typically of concern to the CCTU membership. At first blush, our feeling is that over time the competitive playing field will surely be a digital one and that to remain in the analog mode would be disadvantageous from a number of perspectives. Certainly this has proven to be the case in narrowband voice telephony where integrated digital processing has brought a cornucopia of new services and conveniences to the marketplace.

Will adopting a "U.S. standard" help the U.S. become competitive in HDTV?

No. Using the standards process as a form of protectionism has, in the long run never worked effectively. A far better strategy would be to push for an optimally efficient world stand and, as a fall back strategy, assure that receivers are capable of accommodating each of the few major standards which would alternatively emerge.

What is the long-term cost to corporations of not having a single international HDTV production standard?

Here there are both direct and indirect costs. The indirect costs stemming from potential entry barriers to information markets far outpaces the direct costs of having to build or purchase duplicative network infrastructures.

These costs may or may not become obstacles to the critical path depending on how many international standards develop, and what the protocol conversion complexities amount to between such standards on the transport level.

Will de facto production standards be adopted while the U.S. is trying to make up its mind about a production standard? If so, what would be the impact on corporate communications of such multiple standards?

There is a significant risk that this will take place at the hands of Japanese players who have already provided several U.S.-based entertainment providers with production equipment operating under the Japanese MUSE standard. Even though there is little demonstrable demand for HDTV as measured by consumer dissatisfaction with existing NTSC technology, there is no reason that this strategy, which is fully cognizant of the effect of the nearly ubiquitous availability of prerecorded videotapes on broadcast television revenues will not succeed in the future, just as it has in the past. The case of Compact Disks is illustrative.

Are the competitiveness and economic concerns of corporate communications users currently adequately represented in the HDTV production standards setting process? If not, what changes would you suggest?

No. The voice of the large telecommunications users has not been heard on this critical issue. Multiple reasons exist for this, not the least of which is the misnomer of "television" under which all of this discussion has proceeded. Clearly, we are dealing with a telecommunications issue of major proportions. This is reflected in the composition of the related Government Advisory Committee at the Federal Communications Commission as well as other fora which identify themselves as addressing merely a television issue.

The CCTU would suggest that any future official effort to study the issues comprising "HDTV" include large telecommunications users and that such users be appraised of the broad scope of the issue through notification of their respective trade and industry associations. In addition, to the extent that public notices are used, they should include references to the telecommunications and transport-level implications of the matter at hand, and solicit comments from as broad a telecommunications constituency as possible.

The CCTU looks forward to continued participation in this arena and wishes to be of whatever assistance to the Subcommittee it can as we move closer to defining the issues necessary to adopt a position most-advantageous to U.S. users and providers alike.

Mr. McKinney stated in his testimony that the U.S. is now well positioned to set a production standard, do you support this view?

Not at present. We are in a position to know what not to do, in terms of establishing a production standard, however it is clear that very little has been done in terms of examining the interlocking relationship between production and transport standards. Until we can assert that the U.S. position on the HDTV production-level standard is not at odds with our overall telecommunications goals and objectives, we are not in a position to set a productions standard.

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Answers to additional questions for Richard J. Solomon, posed by the Subcommittee on International Scientific Cooperation.

Q 1. a) Is there any need for new or modified legislation related to the HDTV production standard or the production standard-setting process? b) If yes, what should this legislation include?

A 1. a) Congress as part of its oversight role should encourage, through legislation or otherwise, a more coordinated approach among Federal agencies to the setting of standards, R&D, and trade policy related to high-resolution systems, including HDTV. Agencies could be required to periodically report to Congress on their level of cooperation and coordination.

At present, the FCC is concentrating on standards for advanced or high-definition TV transmission, the Defense Advanced Research Projects Agency is funding basic research in high-definition displays and systems, the Commerce Department is studying the impacts on trade and information infrastructure through NTIA and NIST, and the State Department is negotiating for a production standard with Japan and the European Community. There is little coordination between these agencies, and as a result, the standards process has become somewhat divisive. As I said in my testimony, there does not seem to be any need to set a production standard before the transmission, display, national security, and trade issues are studied further (if ever), and some policies are established in those areas.

b) Congress may need to provide guidance to the State Department in its authorization legislation setting U.S. priorities, in order to clarify the U.S. negotiating position at the CCIR and other international standards organizations in respect to high-resolution systems.

Q 2. Does Commerce or any other Federal agency need to take a more active role in the HDTV production standard-setting process?

A 2. Some Federal presence in coordinating the different interests in U.S. HDTV is necessary. There are disparate industrial and public needs for high-definition systems infrastructure beyond that of the terrestrial broadcast interests. These include motion picture producers and distributors, cable, telephone, satellite and other telecommunications carriers, and the computer and electronics industries. The choice of standards should be made by a consensus of these interests. The Administration needs to lead the debate and see that all interests are fully represented to come to a consensus on U.S. national policy in these areas. Commerce is a rational choice for such an HDTV role, but whatever agency is chosen, it should coordinate with all others working in high-resolution systems.

Q 3. How will the HDTV production standard chosen impact consumer acceptance (i.e., cost) of HDTV? What is the long term cost to consumers of not having a single international HDTV production standard?

A 3. There may never be a single, worldwide production standard for high-resolution systems. A call for a single production standard assumes that all materials for ultimate display to viewers would emanate from the same type of source, that image-capture will never improve or vary, and that the entire store of existing films, TV programs, and other imaging supply has no relevance to the future. The main issue is how to handle different frame rates on the production and display ends. The spatial characteristics, such as number of lines of vertical or horizontal resolution are relatively easy to transcode from one format to another, but spatio-temporal (i.e., frame rates) transcoding is not easy. Today 24 frame-per-second film and 50 and 60 fps video are prevalent, and there are no straightforward methods to overcome this technical problem.

Transcoding frame rates is what the technical stalemate at the CCIR is all about. Most of the discussion on transcoding has gone around in dizzying circles for the past several years, and will never be resolved as long as transcoding is not free, and conventional ways of looking at television are the only acceptable solutions.

Yet, there are powerful ways to handle the transcoding problem in the digital world. I discuss this further in the answer to question 4, including the potential costs to the consumer.

Q 4. What is the right time for the U.S. to establish a HDTV production standard?

A 4. There may never be a right time to establish a single standard, for reasons noted in answer 3. Instead of attempting to find some magical single solution, it should be possible to devise a set of interfaces, using computer-based, digital technology, so that future high-resolution displays will be able to gracefully handle the different sources that may never go away.

A fresh approach is suggested: to devise a "Common Image Format" (CIF) based on a digital representation of the image. This will not necessarily make displays more expensive; in fact, there is much evidence that they would be cheaper than so-called multiport television sets which would require additional components in order to be compatible with existing TV, cable and potential fiber interfaces, VCRs, any interim advanced TV, *and* HDTV. A digitally-conceived CIF could lower costs for the consumer set, optimize transmission, and simplify video production if properly designed.

The CIF would permit a "family" of compatible and extensible standards to suffice for future HDTV, and would have greater utility than any single, rigid standard. I have attached some technical papers which contain suggestions from my colleagues on how this family would work. The underlying idea is similar to the methods used to convert programs and data which work on differing computer systems. Video images can be just another datatype, albeit more complex. MIT — and others — have shown success in manipulating full-motion video as such a datatype.

This concept is akin to that of the page description languages (PDL) commonly used today so that the graphics and typesetting outputs of different computers and computer programs can be compatible with different laser printers. What is needed is a video descriptive language (VDL) which provides a digital representation of full-motion images. The first task toward a VDL would be to devise a model of how video and full-motion graphic systems would work, to be used as a reference; the current effort by the CCIR to establish a CIF could lead to such a model if so directed, and the U.S. could suggest this as a cooperative, international exercise.

However, the work on CIF to date has been primarily to re-define the continual debate on lines, pixels, and frame rates in new words which mean the same old things. As long as the ground rules remain the same, this is no more likely to yield a satisfactory solution for a single worldwide HDTV standard than the past exercise. But a new approach, incorporating efforts to use digital technology in a sophisticated manner, may offer a better way to establish standards for HDTV.

Q 5. Can the phase-in of HDTV be accomplished without the use of additional spectrum through the use of economic signal compression techniques on HDTV channels?

A 5. There are several possible interim implementation strategies for over-the-air HDTV broadcasting in the U.S. Consensus on these strategies is much more important than attempting to determine HDTV production standards at this time. If additional spectrum is not to be made available, there are basically two routes: 1) to completely replace the existing NTSC system with a more efficient technology; or, 2) to supplement the NTSC signal.

Further, there are many economic and social factors to be considered in these plans, not the least being compatibility with existing sets. The FCC has determined that compatibility is important, and that additional spectrum is not to be used beyond that currently allocated in the VHF and UHF TV bands. So any over-the-air system has to deliver NSTC plus HDTV simultaneously in separate channels, or augment the NSTC signal in some manner, or a combination of both methods. Digital signal processing will likely be necessary with any of these strategies in order to efficiently deliver sufficient HDTV information over-the-air within spectrum allocations.

Q 6. How should the HDTV production standard interface with cable, transmission, satellite broadcast and "digital" computer and telecommunications standards? How would you change the standard-setting process to reflect this interface?

A 6. If production signals yielded common digital image formats, the interface for each different transmission or storage media could be optimized. One way this may be done is suggested in answer 4. However, the current standards process is ill-equipped to establish a consensus among the various interests in high-definition systems based on such common formats if only the broadcasters are involved in the process. This is best illustrated by the current narrowly-based discussions on CIF which view HDTV as a mere extension of today's TV. There is nothing inherently keeping the telecommunications and computer industries from participating in the CCIR HDTV debates, for example, but it has not yet happened, perhaps because of the differing cultures involved.

Some coordination could be encouraged by changing the legal mandate of the State Department in this regard, perhaps moving U.S. liaison to the CCIR to a different agency explicitly concerned with development of U.S. high-resolution systems. Another possibility could be for State to insist on closer coordination between the CCIR, the CCITT Study Groups on broadband telecommunications, and work on visual image processing in other standards groups such as the International Standards Organization, the IEEE, &etc.

As noted in answer 1, the Congressional oversight function would be invaluable by calling for periodic reporting from U.S. agencies on their level of cooperation and coordination, as part of the various agencies' authorization process.

Q 7. Are the competitiveness and economic concerns currently adequately represented in the HDTV production standard-setting process? If not, what changes would you suggest?

A 7. Competitive and economic concerns are not overtly recognized by the official standards-setting procedure of the CCIR, however they are implicitly recognized by the European and Japanese interests at this forum. In the past, it was not clear that the U.S. position did incorporate national economic concerns, but I believe that this changed with the State Department position which requested a delay to the next CCIR study period in order to further evaluate HDTV production standards. Other international fora may be more appropriate for discussion of economic concerns, such as GATT and the OECD.

Q 8. *Would adoption of a "digital" instead of an "analog" HDTV production standard make a difference in the competitiveness of U.S. industry?*

A 8. While digital signal processing (DSP) techniques will probably be essential in production, transmission, and display for future TV systems in order to overcome the inherent problems of analog technology, a simple distinction between purely "digital" and "analog" standards is not a useful way of looking at the problem.

Today's TV systems already use significant digital as well as analog electronics. Since high-resolution video by definition requires enormous bandwidths, DSP will be necessary in order to efficiently use scarce over-the-air spectrum. DSP, as well, is needed to overcome constraints in cable and fiber channels, and storage devices. This infers that digital, computer-based components will continue to grow in importance for every segment of complete high-resolution systems. DSP needs to be fully recognized in the standards setting process, so that transition and ultimate scenarios can be based on greater realism as to what is possible for advanced television. As I note in answer 4, digitally-based common image formats can go a long way to resolving the fundamental HDTV standards issues raised at the CCIR which relate to frame rate.

A digital CIF builds on American technological prowess. The U.S. is on par or ahead of other countries in DSP techniques, in digital computer software, and in related digital hardware. Any TV system that relies heavily on digital electronics, and adds to these strengths, will likely be to the advantage of U.S. industry and the American economy.

Q 9. Will adopting a "U.S. standard" help the U.S. become competitive in HDTV?

A 9. The current HDTV standards debate is mired in such distracting details as number of lines and pixels per line, which is not the technical high-resolution problem at all. Adding one more standard similar to the narrowly-based, "throwaway" systems proposed by the EC and Japan is unlikely to help anyone.

Alternatively, if the U.S. pre-empts this debate with much more useful high-resolution technology compatible with regional standards (both existing TV and HDTV), compatible with film, compatible with evolving computer graphics, and extensible for the future, our production, electronics, and computer industries *could* gain a competitive advantage. That is a big "if," for overseas competitors are thinking along those lines as well. The paradox is if we do nothing at all but wait we will get further behind in the advanced technologies that are expected to spin off from high-resolution implementations in the coming decades.

There are some activities in which the U.S. could lead. Over-the-air HDTV transmission is one area where we are forging ahead, thanks to the FCC Advanced TV Inquiry. Displays, thanks to DARPA, may be another. However, setting "U.S." standards is tricky: For the electromagnetic spectrum, the government has a defined role to play in setting parameters for use. But for specific component technologies, such as displays, cameras, production, and post-production subsystems, it may even be counter-productive for standards to be set by the government. What would help U.S. competitiveness would be for the government to provide leadership and coordination so that U.S. industry can develop a consensus.

Q 10. Will** de facto **production standards be adopted while the U.S. is trying to make up its mind about a production standard? If so, what would be the impact on U.S. competitiveness of such multiple standards?

A 10. As noted, there are many sources of production for high-resolution systems. Film is one of these, and in that area the U.S. leads, and film is still quite competitive with electronic imaging for high-resolution. The resolving power and sensitivity of the latest films far exceed anything demonstrated in electronics by the European Community's Eureka and Japanese NHK HDTV systems.

Electronic high-resolution imaging will come eventually, and federal investment in R&D towards this end should be encouraged. But there is no real danger of a single *de facto* production standard emanating from either of the two current HDTV proposals, since so far they are only good enough for niche markets. They are not equal to film for theatrical presentation, and are neither downwardly compatible to existing systems nor upwardly extensible for the future. Multiple standards in niche, or "throwaway" markets will only encourage further application of digital signal processing techniques in display, storage, and transmission systems in order to harmonize a set of "friendly" standards based on a digital common image representation. That could be our strength.

There is a *caveat* here: The niche markets are not sufficiently large to have a major economic impact in and of themselves, but they are useful for the learning curve. The U.S. needs to adopt a set of HDTV policies early so that our industries can get on this learning train which represents the future of electronics; the EC and the Japanese have given us fair warning that the train is about to leave the station. We do not need another obsolete production standard to buy a ticket at this time; instead we need a policy that guides our industrial strengths, taking into account what our competitors are doing.

Q 11. Mr. McKinney stated in his testimony that the U.S. is now well positioned to set a production standard, do you support this view?

A 11. The U.S. as the world's largest, most stable, and richest market for vision systems is well positioned to set any standard, if we so choose. We do not have to accept any technology proffered, but can require others to negotiate with us. We have the strengths of well-integrated broadcast and well-integrated telecommunications industries, of the world's leading production firms, of an advanced electronics and computer base, and of consumers with large living rooms. So if we can find a consensus strategy among the various interests, the rest of the world is likely to follow us or be cut out of *our* high-resolution systems market.

But, to repeat my testimony and the answers to questions above, this strategy should emanate from the bottom up — displays, transmission, compatibility with existing equipment and computers — not from top down which dictates in advance technological choices proprietary to overseas firms. With open, common image interfaces for display and transmission, it matters not which production system is used, as long as the interface formats are contained within a set of acceptable parameters.

This common set of computer-based, high-resolution image formats is the type of standard with which the U.S. can lead the rest of the world. The advantages of simultaneously providing a transition strategy for today's television and cable industries, and leapfrogging the obsolete, throwaway technologies of the Europeans and Japanese, outweigh any shortterm requirements for another conventional HDTV standard.

— Richard J. Solomon
June 17, 1989

RESPONSES TO THE QUESTIONS FOR MR. JOEL CHASEMAN

Subcom. on Int'l Scientific Cooperation
5/31/89 HDTV Hearing

1. a) & Q Is there any need for new or modified legislation related to the HDTV production standard or the production standard-setting process?

1. b) Q If yes, what should this legislation include?

A We do not believe that there is a current need for new or modified legislation relating to the HDTV production standard or production standard-setting process. The process seems now to have been properly ordered so that the initial focus will be on a transmission standard and the secondary and subsequent focus will be on a production standard.

2. Q Does Commerce or any other Federal agency need to take a more active role in the HDTV production standard-setting process?

We do not believe that Commerce or any other Federal agency needs to take a more active role in the HDTV production standard-setting process. However, we encourage them to continue their support and advisory role in this process. We would answer this question differently if it concerned the transmission standard-setting process, where we believe the FCC, the Commerce Department and Congress have an important facilitating role which they are, by and large, effectively playing.

3. Q What is the long-term cost to the broadcast industry of not having a single international HDTV production standard?

A The long-term cost to the broadcast industry of not having a single international HDTV production standard is not nearly as great or threatening as the cost and risk of not having a single HDTV transmission broadcast standard for this country. Nevertheless, broadcasters do create a product (programming) which, despite foreign barriers, is much sought after, is a large export for the United States and makes a positive contribution to our balance of trade. A single international HDTV production standard would facilitate international commerce in programming where Americans seem to have a particular expertise. On the other hand, a single international HDTV production standard that is the wrong standard could lead to an HDTV transmission system in this country which would be wholly unsuited for local broadcasters and the service they render to the American consumer.

4. Q What is the right time for the U.S. to establish an HDTV production standard?

A After it has set the appropriate transmission standard.

5. Q How will digital HDTV and digital transmission technology impact broadcasters and how should this be reflected in the selection of an HDTV production standard?

A We do not believe that a digitally friendly HDTV production standard would seriously impact the present process of selecting a production standard.

However, neither digital HDTV nor a spectrally efficient digital transmission technology suitable for over-the-air transmission has yet to be invented. One has only to look at the time and efforts expended so far in developing a robust and spectrally efficient wireless voice transmission (almost 20 years) to realize that such a technology will not be available in the near future.[1] In the long run, fully digital HDTV and digital transmission technology may facilitate broadcasters' quest to provide the American public with television of the highest technical quality.

However, if exclusive reliance is placed on digital as the ultimate solution, American broadcasters and the American public could lose out in the intervening years when analog HDTV is developed and spreads throughout the United States. Broadcasters could be left without a suitable analog HDTV technology for their service; American manufacturers who do not participate in analog HDTV developments may not survive to participate in digital HDTV; the American public may confront analog HDTV technologies that are unsuited for its local television service, and consumers may not care about the incremental quality that long-term digital HDTV may represent in the future over an intermediate analog HDTV system.

1/ If it develops more quickly than our engineers tell us it will, our testing and evaluation process will be open to it as well as to all other HDTV technologies.

6. Q Would adoption of a "digital" instead of an "analog" HDTV production standard make a difference in the competitiveness of the U.S. broadcast industry?

A For the reasons described in response to Question 5, we do not believe that this would make a difference.

7. Q Should the phase-in of HDTV be accomplished without the use of additional spectrum through the use of economic signal compression techniques on HDTV channels?

A If it were possible to phase HDTV in through the use of economic signal compression techniques while protecting existing service, broadcasters would be very enthusiastic about this strategy. It would save them enormous capital expenditures and the risk of disrupting the public's service. But broadcasters' engineering experts believe that compression techniques by themselves fall short of offering the technical quality necessary for broadcasting to be competitive with the HDTV technologies that their other competitors may implement. Furthermore, compression techniques may provide only a short-run improvement and lock broadcasters into a certain level of improvement which the other media will surpass in the future. Broadcasters are committed to developing a strategy and investing in expensive facilities that will enable them to remain competitive in both the short run and long term. Therefore, broadcasters cannot put all their eggs in the one basket of high-compression techniques.

8. Q What is the broadcast industry's reaction to setting an HDTV production standard which also takes into account the concerns of the telecommunications and computer industries?

A We think this question is more meaningful if interpreted to refer to a transmission standard. We do not believe that it is appropriate at this time to rule out standards which would accommodate the telecommunications and computer industries. However, the principal focus should be on facilitating access of all the American public to low-cost, high-quality-technology television service. Most knowledgeable people believe that developing a system that would accommodate telephone communications and computer technology would substantially increase the cost of HDTV and, therefore, make it inaccessible to large segments of the public. That would be undesirable. The focus should be on developing a standard that makes sense for the viewing public, and only secondarily should consideration be given to whether it can be adapted to accommodate the telecommunications and computer industries without substantial additional cost to the American consumer.

9. Q From a broadcaster's perspective, what are the key forces that will drive consumer acceptance of HDTV?

A The key forces that will drive consumer acceptance of HDTV are (1) the availability of broadcast service on HDTV, (2) quality, and (3) cost. An HDTV system that is not available on free television will be much more costly to implement in home receivers (because it will lack economies of scale) and will create an undesirable information split in our society between the rich and poor. One of the functions of the testing process which the broadcast industry is spending millions of its own money to conduct is to determine what elements of HDTV the public really cares about and to evaluate them in terms of costs and benefits to the American consumer. We hope in that way to enable this country to select an HDTV system that suits consumer needs, is not unduly costly and yields very good quality.

10. Q Will de facto production standards be adopted while the U.S. is trying to make up its mind about a production standard? If so, what would be the impact on the broadcast industry of such multiple standards?

A It is possible that de facto production standards will develop to some degree during the international process of considering various candidate production standards. There is some risk that this will make more difficult the exchange of programming. However, we do not believe that this impact on the international flow of programming will be substantially inhibiting. We prefer this slight "minus" to the substantial disadvantages that would result from the premature adoption of a production standard that would be unsuitable for Americans. In any event, we do not believe it is possible in the short run to convince the rest of the world to adopt a production standard that would be favorable to our country's interests. Indeed, until we undertake the necessary testing of transmission technologies, we won't ourselves know what production standard will best serve the needs of the American public.

11. Q Mr. McKinney stated in his testimony that the U.S. is now well positioned to set a production standard. Do you support this view?

A We agree with Mr. McKinney that the United States is well positioned on the production standard issue. It is not clear to us that the world will ever be able to set an appropriate international production standard and it plainly cannot do so at this time. In other words, this country may not be well positioned to set a production standard, but it is well positioned to pursue the American consumer's best interests with respect to the production standard issue. The next task for the United States is to get on with the development, testing and selection of a suitable HDTV transmission system. It is to that task that we broadcasters are devoting substantial resources, ingenuity and expedited efforts. Other industries in the private sector and the government need to support this effort. And we believe that, too, is occurring.

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